AMERICAN MACHINIST

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Davis Key-Seat Cutting Machine.

We illustrate herewith a new key-seat cutting machine, with details, as made by William P. Davis, North Bloomfield, N. Y.

The perspective engraving represents the machine complete, as in the operation of cutting a key-way in a pinion, while upon the floor are seen specimens of finished work. The construction and operation of this machine will be apparent from the lettered detail engravings.

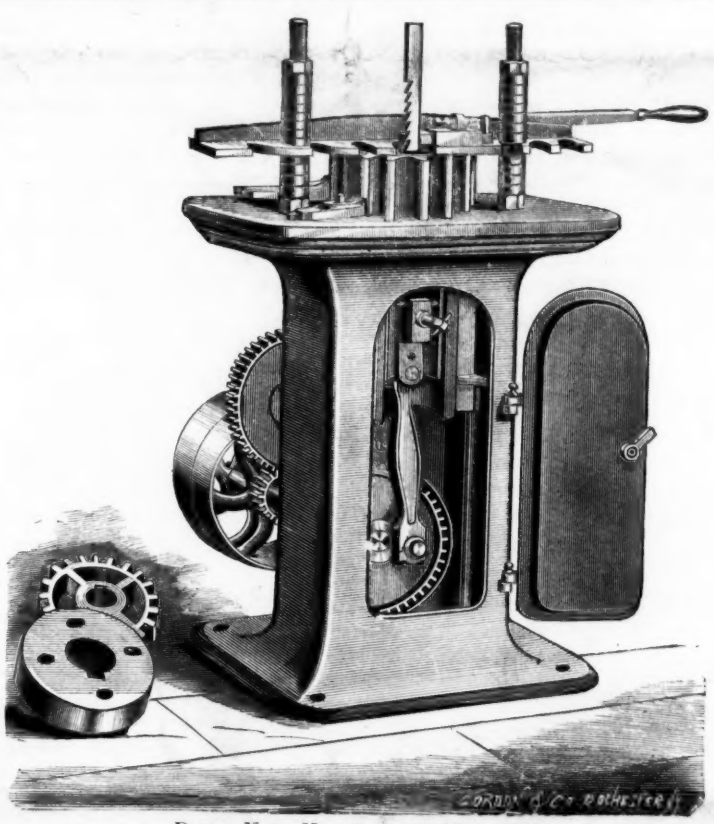
In Fig. 1 the machine is shown to consist principally of a cast-iron box or frame *A*, which contains the mechanism for operating the cutter.

Fig. 2 is a plan, and Fig. 3 a vertical section through line, *x*, *x*, Fig. 2 showing the driving mechanism. This machine is adapted chiefly for cutting key-ways in the hubs of wheels and pulleys.

Such work to be operated upon is placed upon the table *B*, to which it is firmly secured by the clamp *C* and the stud bolts, *g*, *g'*.

These stud-bolts are sufficiently long to admit the largest work intended to be done upon this machine. The studs are well supplied with collars, *h*, *h'*, which enable the operator to adjust the clamp at any desired height from the table.

Work of various diameters may be accommodated by means of extra holes in the table and slots in the clamp *C*, for spreading the studs, *g*, *g'*. The reciprocating saw, or cutter, *D*, is merely a straight milling cutter, having a large number of teeth on its surface similar to the teeth on a rotary cutter. But, instead of a continuous rotary movement of the teeth, as on an ordinary milling cutter, this cutter has a reciprocating movement alone. It receives its motion from the crank pin *a*, in the gear *F*, through a pitman *G*, and crosshead *b*, working between two guides, *c*, *c*. The cutter *D*, can be changed and different sizes substituted by simply removing the pin by which it is attached to the crosshead. A sufficient power for driving the cutter is furnished by a belt upon the tight and loose pulleys, *H*, *H'*, Fig 3, communicating motion to the gears, *J*, *I*, *L*, *F*.



DAVIS NEW KEY-SEATING MACHINE.

Fig. 4, page 2, shows the feeding mechanism. It consists of a toothed segment *n*, operated by the lever *P*. The toothed segment *n*, gears with a rack on the slide *l*, and is pivoted to the stud *o*. The cutter is represented at *D*. By moving the lever *P*, this cutter is moved to or from the work.

Fig. 1

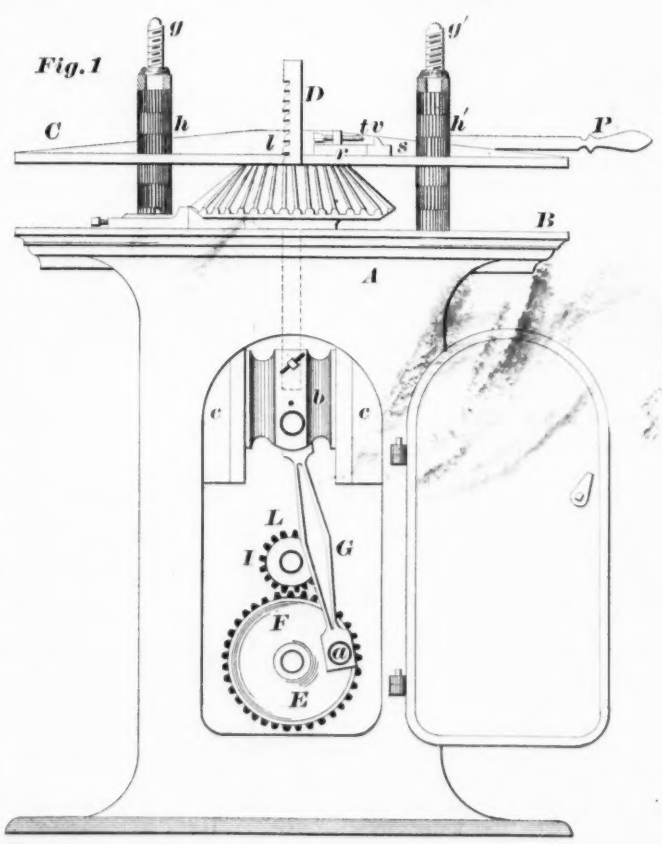


Fig. 2

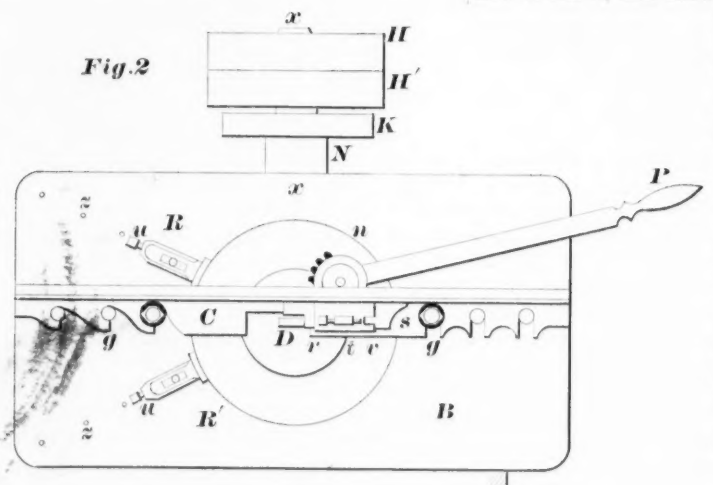


Fig. 3

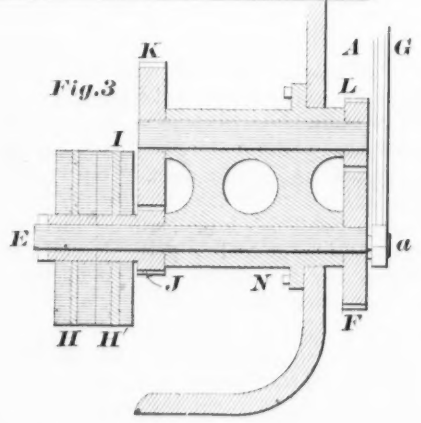


Fig. 5 shows how the cutter may be adjusted to cut tapered key-ways, which may be done by setting the cutter at the required angle. The screw *r*, operates a stop to limit the motion of the slide *l*, which determines the angle of the cutter in relation to the face of the work, and also its relation to the surface of the table *B*.

By placing a square upon the table, and adjusting the cutter to stand at right angles with the face of the table, as shown, a vertical alignment is secured. The lug *s*, being in contact with the end of the screw *r*, and the pitch of the screw being known, it will be found an easy process to set the cutter at the angle required. For example, if the screw has sixteen threads to the inch, one full turn will move the cutter $\frac{1}{16}$th inch, and so on. The work to be operated upon is supported by the chuck blocks, *R*, *R'*, Fig. 2. These blocks may be adjusted by means of bolts placed in the radial rows of holes, *z*, *z*. The details of these chucks will be comprehended from an inspection of Figs. 6, 7, 8 and 9. *X* is the collared set screw for holding the block; *Y* is a pin that fits in a hole in the table. The block, which bears against the work, is adjusted by the set screw *U*.

This machine was designed for use in shops where it would not pay to purchase a slotting machine to do such work, and a planer could not be spared; besides a planer, would be too unhandy for much of the work that could be done with ease and very expeditiously upon one of these machines. Furthermore, this machine is adapted to various kinds of work which are not herein alluded to.

Extracts from Chordal's Letters.

REGULATION CUTTING TOOLS IN SHOPS—AN OUTRAGEOUS ROUGHING TOOL—INDIVIDUALITY IN TOOL MAKING—A PLANER EMBODYING IN ITSELF THE SKILL TO WORK IT—CHORDAL'S SPIKE MACHINE—SEARCHING FOR ORIGINAL INVENTORS OF COMMON MACHINES.

Mr. Editor:

* * * In my last letter I incidentally referred to that class of machine shops which give a man a machine to run and show him how to run it, and show him what tools to work with. Shops like this do not permit a man to use anything but the regulation tools. The obligation to use a certain form of tool is more galling to the average machinist than the requirement to wear a certain livery, and it don't seem to make much difference whether the required form of tool is good or bad.

One thing to be said in favor of regulation forms of lathe and planer tools is that the form is generally established upon some kind of a system. And it is the result of my experience and observation that wherever you find anything that looks like system, you will always find that system based upon previous study.

The man who proposes to introduce into his shop a standard form of roughing tool, for instance, will ransack the world to find the best form of tool. If he went at it in a hap-hazard manner, I don't see anything to interfere with his choosing the worst form. System is most always based upon scientific deduction from varied experiences.

The presumption is, then, that a shop which requires a lathesman to use a certain

form of roughing tool will see that the form determined upon is a superior form.

I suppose that my own experience at the lathe is about like that of other lathesmen. I had hobbies, and bad ones. I had pet lathe tools which were a pure waste of steel. I also had good hobbies, and had some splendid tools—tools that would cut iron, and lots of it, and require the least amount of grinding, and the least amount of dressing for the removal of a given amount of iron in the least time, and all such as that.

As a lathesman I was simply an ordinary, in fact, a very ordinary hand. But human nature is human nature, and I do not now think that I ever did, or ever could, or ever would, or ever will work in a shop where another man dictates the shape of the tools that I use.

* * * But in my shop I shall have certain forms of lathe tools for certain purposes, and the lathesmen will have to use them or go to another shop to earn their bread and butter.

* * * I was at one time foreman in one room of a certain large shop. This room was somewhat apart from the general rule of the shop in regard to the tools, the work of the room being entirely special. The main shop had a tool room and in that tool room all the lathe tools were kept, and the workman was supposed to go to that tool room and get a certain lathe tool, just as he would get a certain twist drill, or reamer, or tap. Threading tools, tools for cutting square threads, cutting off tools, &c., are matters in which few lathesmen would differ, and all experience points toward the same form. But when it comes to roughing tools, and finishing tools, and boring tools, and even side tools, what lathesman is there who has not some idea of his own?

In the particular shop that I refer to, the standard roughing tool was the most outrageous, inefficient affair that I have ever seen. Lathe tools are terribly hard things to make drawings of, or I would send you a sketch instead of trying to describe this one. It was simply a round nosed tool, drawn slightly smaller than the steel bar, and bent upwards a trifle; about such a tool, in fact, as the average man uses in roughing out heavy brass work. It was not a cutting tool in any sense of the word, and it could not be ground to form a cutting tool. The most that could be said of it was that it was a scraper, which did not bevel the wrong way. This was the roughing tool for castings, and forgings, and bar iron, and face work. This shop had many apprentices, and such were the tools they were brought up on.

Once in a while some insubordinate man would be hired who, by some hocus-pocus, would get a genuine diamond point tool dressed with a good, keen cutting end, and the rear a little bit lower than the point, and he would pile a lot of big chips under his lathe, which would be a novelty in the shop and a profanation to the apprentices. This novelty always had to give way to the prevailing system.

When dull times came, this shop, like many others, got dull and empty. When times picked up, many new men came. Work had to be done. Few men could be found who would tolerate the standard tool. The consequence was that the standard fell overboard. I was in the shop about a year ago and saw about as good-looking chips under the lathes as you will see most anywhere. Once in a while I saw some fellow nibbling away with the old standard tool. I suppose he served his time in the shop.

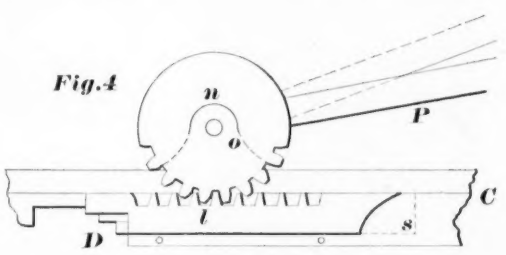
* * * It seems strange that there should be more individuality in the matter of tools among metal workers than among other mechanics, but such is certainly the case. I never heard of a carpenter who had any ideas of his own regarding a hammer, or a gimlet, or a brace, or a bit, or jack-plane, or anything else, in fact, that he uses. His choice is limited entirely to the stock of the hardware store. This might lead to the thought that as the carpenter was not the fabricator of his own tools his originality was never led into the direction of their shape. Still, we find a carpenter once in a while who makes his own planes, or bevels, or even his brace. But these home-made tools are never known to vary a particle from the market article from which they are copied. If a carpenter makes himself a jack-plane he will measure the bevel of some old one so as to get the bevel on his own exactly like it.

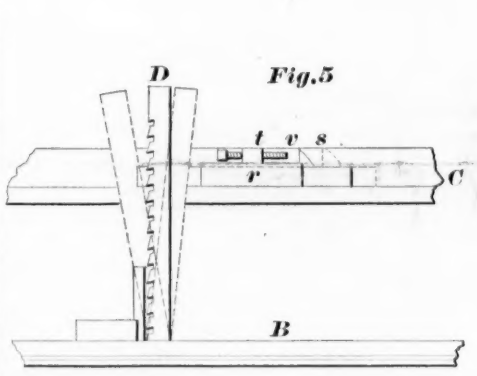
* * * The stone-cutter is a man who requires as much tool dressing as the machinist. He does not make his own tools, but they are always dressed under his personal supervision. You can rarely find a stone-cutter who can show you any tricks in regard to the points or handles of tools.

* * * There is something generative about everything connected with the machine shop, and it is no satisfaction to me to look upon those progressive systems which leave out of consideration entirely the individuality of the workman. That is the way I will do it myself, however.

* * * The individuality of the average machinist seems to run more to fancy than to utility. The fancy may run to absurdity, but never to attractive grotesqueness.

Once in a while you will find a machinist who in making his own small tools will insist on making them different from anything he has ever seen, even though they are not





quite so good. This is a very good trait in a mechanic, for it exhibits a capacity for making things different.

I once saw a machinist making a scratch-awl, with the usual center twist. He got it hot, screwed it up in a vise and was all ready to give it the twist, when he suddenly dropped everything and left the blacksmith shop in order to see which way some other certain scratch-awl was twisted. That fellow was a simple numbskull, who deserved to be set to work at a lathe and to be made to work with standard tools all his life.

* * * If working men were business men they would pay more attention to the principle involved in cutting tools. When a shop adopts a certain first-class form of tool, certain in its efficiency and established in the general merit, there will be trouble in introducing it into the shop. The workmen who have never investigated the subject of cutting tools before, will say that they have investigated this particular one, and that it ain't worth the powder to blow it up. But take the same lot of men and let their wages vary with the amount of work they do and they will begin to recognize the merit of the meritorious tool. This I believe to be the experience of every shop which has ever tested the plan of employing standard shapes for cutting tools.

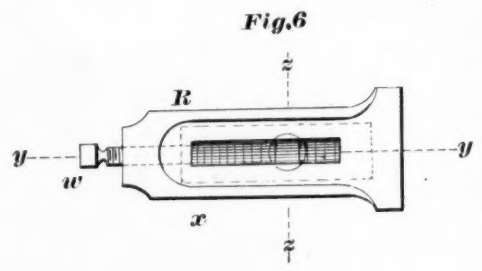
* * * There are some shops in which ignorance on the part of the workmen is presumed upon, and a plan is accordingly laid to utilize this ignorance as well as possible. Precious little encouragement common sense gets in such a concern—in the rank and file of the workmen, I mean. It is the only way to work poor labor, and it is the poorest way to work skill.

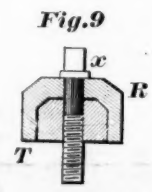
* * * I once went three hundred miles on a pilgrimage to see the front door of a certain shop. I talked with the proprietor, and for some reason unknown to me he supposed I had a sympathetic ear.

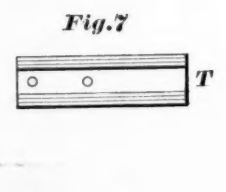
He told me a little story. Said he: "Some time ago we had some visitors, and among the rest was a clergyman. He knew nothing of working in metals. He saw one of our men planing a piece of iron and doing a perfect job. The work was smooth and free from chatter. The reverend gentleman rubbed his finger over the work, and then remarked to me, 'That man must be a splendid workman. Isn't that surface nice?' Now, you see, that preacher thought it was the workman, when in fact it was us! WE furnish the planer and dictate to the workman how he has to proceed."

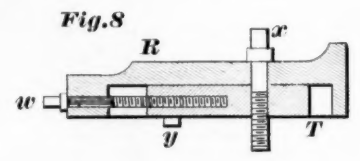
As this shop owner told me this story there was in his face a woe-begone look of sadness, and a something or other that showed that the world, in its ignorance, did not appreciate how much of its progress was due to us; and the look haunted me till I got home. I have often thought since that I ought to have gone right back and furnished my small share of condolence.

This shop owner ought to have had the sense, however, and was certainly old enough









to know, that preachers are apt to be ignorant about some things, and liable at any time to give a poor, good-for-nothing lathe hand credit for workmanship which in reality belonged to the face-plate.

* * * We all have crosses of this kind and have to bear them. I once got up a machine for making railroad spikes. I took lots of people to see the machine, and they went into ecstacies over it, and over the man that ran it, and over the spikes it made, and over the bars of iron it made them out of, but they never had a particle of admiration for me. I never expected much appreciation from mechanics who knew anything about machinery, because, to tell the truth, the machine was not a very good spike machine. It didn't make nice spikes, and wouldn't make many of them. It wasted material and took lots of power. But I did think that I was entitled to some little congratulation when I exhibited the machine to a preacher, or a professor, or an importer of Irish linen.

* * * Have you ever noticed, Mr. Editor, how bitter is the strife for empty honors? The machine trade is a creative one, and I believe that in it you can find much of this strife in its worst form. Where there is a real object which may be possible of attainment, there is some sense and reason in looking toward that attainment.

Of this class is patent litigation, where, we may say, the honor of prior invention is involved. But really the object sought after is the money value which comes from the decision of priority. Look at the terrible legal battles of Morse, and Corliss, and Plympton, and Goodyear, and Bell. These men were not fighting for the glory of the invention, but for the hard cash which belonged to the first inventor. There is nothing childish in such a fight. But after an invention is about a century old, and the world divides and begins to cudgel for the two champions, where is the sense in it?

These old questions of prior honor can never be definitely settled. The honors will never be universally conceded. The title will always be defective. The escutcheon will always bear a stain.

The question as to who invented the locomotive will always be a question, probably. But the real fact is, the world don't care who the first man was. The locomotive has descended, or ascended, if you please, from a glorious accomplishment to a practical every-day thing, and the world cannot associate with it a thought of glory for him who would be foolish enough to spend a lifetime in establishing the fact that he was the first man to contrive one.

* * * Very respectfully,

CHORDAL.

It must have occurred at some time to nearly everyone that there is a difficulty in copying machines and machinery that is hardly explainable from natural causes. The copy may appear, even to the critical observer, to be like the original, and yet fall far short, in working, of giving anything like the same degree of satisfaction. The fact would seem to be that the designer and builder of a machine—a particularly good one—builds a good deal of himself into it, and that this essential part cannot be readily copied. Every man has more or less of the inventor in his composition, and copying entire is unnatural. Even if the intention is to strictly copy, unless the copyist sees with the eyes and by the experience of the originator, it is no easy matter to do so, and the unseen and uncopied features may be the very ones essential to complete success. If he does see as the originator sees, he has no need of copying. Many a locality has become famous for the manufacture of some specialty, and retained its fame for years, in spite of repeated efforts to transplant it, because in these efforts some little point too insignificant to attract attention has been overlooked. So, in the attempt to copy machines that have attained a reputation, the originator can, in the majority of instances, rest secure in the knowledge that something essential will escape the observation of the most painstaking; that he has built something into the machine that cannot be copied. There is a world of common sense in the remark of a mechanic and manufacturer, that he had no hesitancy in allowing his processes to be overlooked by others, because if they did not know enough to originate processes of their own just as good, they did not know enough to successfully copy his.

Fifty-five candidates for membership, one for associate, and one for junior, will be voted upon for admission to the American Society of Mechanical Engineers, at the Cleveland meeting, June 12th.

We are indebted to James M. Swank, Secretary of the American Iron and Steel Association, for "Statistics of the American and Foreign Iron Trade for 1882" and "Iron and Steel Industries of Pennsylvania." These two pamphlets are valuable to have at hand for reference.

The American Consul at Buenos Ayres, S. A., writes to the State Department under date January 20, 1883, that besides the 2,000 miles of railway already in operation in that country there are nearly 1,000 miles more in process of construction. Most of the latter are in the hands either of the general or of the provincial governments, and the business of furnishing the necessary rolling stock must amount to many hundreds of thousands of dollars in the next year or two. The Consul says mining machinery and sugar-making machinery are special directions in which American manufacturers may open up a good trade with that country.

Programme for Meeting of the Mechanical Engineers.

The secretary of the American Society of Mechanical Engineers, F. R. Hutton, has issued a circular to members giving a programme for the meeting at Cleveland, O., beginning June 12th. We make the following extracts:

LOCAL COMMITTEE OF ARRANGEMENTS.

J. F. Holloway, Chairman.

C. F. Brush,	S. T. Wellman,
W. M. Barr,	E. H. Martin,
Ambrose Swasey,	John Walker,
N. S. Possons,	J. D. Cox, Jr.,
W. H. Thompson,	W. R. Warner,

F. H. Richards.

EXECUTIVE COMMITTEE.

S. T. Wellman,	J. F. Holloway,
Ambrose Swasey,	J. D. Cox, Jr.

The sessions of the society will be held in the rooms of Cleveland Vocal Society, City Hall, Superior street.

The headquarters of the society, and of the secretary, will be at parlor A, Forest City House, fronting south-west corner Monumental Park.

First Day—Tuesday, June 12.

Opening session, 8 P. M. General business, reading of papers and conversazione. It is hoped that this meeting will be largely attended, in order that visiting members as well as newly-elected members may become acquainted with each other. The Local Committee have extended an invitation to the Civil Engineers' Club of Cleveland, to be present at the opening meeting, in order to add to the pleasure and the sociability of the occasion.

Second Day—Wednesday, June 13.

Morning session, 10 A. M. Reading of professional papers and general discussions.

Afternoon session, 2.30 P. M. Reading of papers and discussion continued. In the evening the members are invited to a reception given to the society by citizens of Cleveland.

Third Day—Thursday, June 14.

The day will be devoted to excursions by special train among the prominent iron and steel works and the large manufactories of the city. Among the places to be visited are the Otis Iron and Steel Works, Cleveland City Forge and Iron Company, Cummer Engine Company, Union Screw Company, Brush Electric Company, Warner & Swasey, Cleveland Malleable Iron Company, the extensive iron and steel works of the Cleveland Rolling Mill Company, Eighteenth Ward, the Standard Oil Company, Central Furnaces of the Cleveland Rolling Mill Company, the Iron Ore Docks, City Water Works, etc.

The train schedule, with definite information as to the time and place of starting, etc., and with possible changes as to places to be visited, will be distributed at the time of the meeting.

The evening session, 8 P. M Reading and discussion of papers and adjournment, unless it shall prove necessary to order a session for the following day.

Among the papers already in hand for the meeting are the following:

The Marine Engines of the Lakes, with a Device for getting them off their Dead Centers. By J. F. Holloway.

History of the Winding and Pumping Engines of the Anthracite Regions.

Balancing Vertical Engines.

The Bower-Barff Process. By W. F. Durfee.

Standard in Pipe Fittings. By Wm. J. Baldwin.

Ingot Cranes. By Gram Curtis.

Spiral Springs; Compression and Tensile. By Oberlin Smith.

Other equally interesting papers are promised.

It is hoped that the place selected for the meeting, together with the date named, will induce members, as far as possible, to bring ladies with them. Provision will be made for their entertainment while members are engaged in the meetings or are away on excursions.

Economy in the Management of Locomotives.

BY LEWIS F. LYNE.

One of the most essential considerations in the running of locomotives is, or ought to be, the internal lubrication of cylinders and slide valves, yet this subject is treated by many railroad companies with marked indifference. What I mean by this is, that lubricants in the shape of tallow and oil are poured into the cylinders of locomotives in unreasonably large quantities, the greater part of which is blown out upon the first admission of steam and is wasted. Furthermore it does great damage by being baked upon the inside of the exhaust nozzles, reducing their diameter and creating an immense back pressure. The netting in the stack is also clogged up more or less by this waste of oil and tallow.

The time when lubrication in the cylinders is most neglected yet most needed is when the train is ascending heavy grades, and in starting a heavy train from stations. Any person can readily prove to his entire satisfaction the immense extra strain to which a locomotive is subjected in starting a heavy train, by placing himself by the side of the cylinder and watching the jerky and uncertain movement of the valve stem. When a locomotive is drifting into a station the heat contained in the iron surfaces quickly evaporates the moisture remaining after steam is shut off. When the signal is given to start, the surfaces being dry and hot move upon each other with great difficulty. I have known rock arms to have been sprung under such circumstances, and in one instance a rock arm was twisted off owing to the great friction of the valve upon its seat with all the ports closed.

An experiment to ascertain the power required to move a valve under similar conditions may be tried by disconnecting the valve rod from the valve stem and attaching a lever, and weighing the amount of power applied to move the valve with the boiler pressure upon it. I am convinced from my own experience that the result will very much astonish those who try this experiment.

Considerable difficulty has been experienced in feeding a lubricant to locomotive cylinders continuously, owing to the great variations of pressure in the steam chest, and particularly when the throttle is closed, as it is is when the train is drifting or running down hill. I saw a device upon a locomotive the other day which fed a stated quantity of oil to the cylinders as well when steam was shut off as when the throttle was wide open. In this device boiler pressure was maintained in the pipes leading to the cylinders. It was at all times greater than the pressure within the steam chest, so that when once started and regulated the oil would be fed continuously to the cylinder throughout the entire trip. The cylinder head was removed at each end of the trip, when the surfaces of the cylinder were found to be covered with a thin film of oil. The quantity used during the entire trip was about six drops per minute. The lubricator here mentioned has been in use sufficiently long to prove beyond a doubt that it is reliable under all ordinary circumstances.

It is found that the locomotive thus equipped handles very much easier and performs its work with much greater ease than before the continuous lubricator was applied. These facts naturally lead the reader to believe that there must also be a saving in coal, as well as a great reduction of the quantity of lubricant used. One pint of oil fed automatically to the cylinders has been made to answer for a run of about 130 miles, and there is reason to believe that in time a less quantity than this will be found sufficient.

The advantages of an anti-friction device attached to the slide valves of locomotives are also becoming more and more appreciated. Since the illustration of the Allen slide valve with the application of a balancing device in the AMERICAN MACHINIST of Feb. 25, 1882, this combination has been applied to a large number of locomotives upon different railroads in this country where it has given very excellent results.

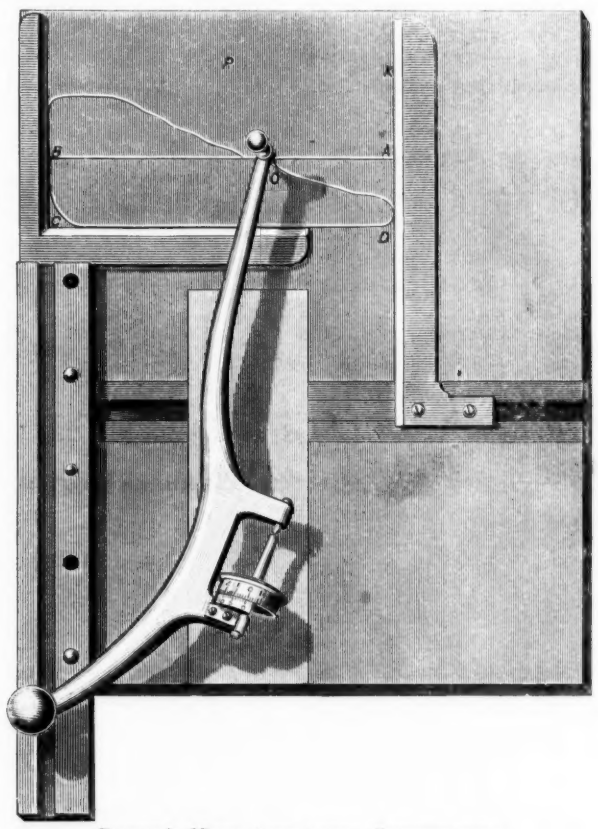
I suggested the application of a pair of valves like those alluded to upon a locomotive running a fast passenger train. They were put to work and ran for a period of fourteen months without repairs, during which time the locomotive ran 44,168 miles. Before these valves were applied it was necessary to face the seats every six weeks, and the valves could never be kept tight. About seven tons of the load upon each valve was removed so that the power required to move them was so much reduced that the engineer could move the reverse lever to any desired position with one hand.

In starting out of a station, the latch being lowered upon the face of the quadrant, the driving wheels would frequently make two or three revolutions before the latch would drop into a notch, showing that there was very little power consumed in working the valves. An expert test of these valves against the ordinary *D* slide would perhaps show a small difference in favor of the balanced valve. There would necessarily be a better efficiency shown in favor of the balanced valve due to the reduction in the friction, but the greatest advantages lie in an immense saving in the wear and tear of eccentric straps, links, pins, valves and seats. The steam that would be otherwise lost though leakage of the valves is saved. Furthermore, the quantity of lubricant used upon the parts is very much reduced. When once squared the valves remained so, whereas before the change was made they could hardly be kept square two days at a time.

Another important consideration is to know the efficiency of the various classes of locomotive boilers. Heretofore it has been a very difficult matter to measure with accuracy the quantity of water fed to the boiler. It has generally been done by floats, or by weighing the tank before and after the trip, the difference being the quantity of water used. These methods involve too much trouble.

I place a Worthington water-meter inside the tank and locate the recording mechanism on top, or place the meter in the coal box and connect the meter with the feed pipe. If pumps are used, the meter will record within a tenth of one per cent. the quantity of water fed to the boiler. When injectors are used, the waste must be returned through a hose to a receptacle in the tender, and the amount deducted from that indicated by the meter. The difference will be the quantity fed to the boiler.

Then by weighing the coal, which is an easy matter, we can readily ascertain the precise efficiency of the boiler. Almost every engineer has a different method of working his locomotive. The coal is not accurately weighed, neither is the quantity of water measured, therefore he does not know, nor has he any means of knowing, which is the most economical way to work his engine. By applying the meter to measure the water and weighing the coal, and working the engine differently each day, keeping careful and accurate records, it would readily appear which method offers the most advantages. These experiments would also suggest other advantages to be derived from the results obtained for any number of that class of engine.



COFFIN'S NEW AVERAGING INSTRUMENT.

Coffin's New Averaging Instrument.

The accompanying engraving represents a modified and very much improved form of the Coffin Averaging Instrument which was described in the AMERICAN MACHINIST of Sept. 10, 1881. Since that time arrangements have been made with the Ashcroft Manufacturing Company, 111 Liberty street, New York, who are now manufacturing this instrument. In its present form the board is of a convenient form to fit in the till of an indicator box, while the instrument itself is contained in a neat velvet-lined morocco case for the pocket.

The improvements consist in modifying the construction of the sliding clamp *K*, making the instrument of a better and more convenient shape. The end that slides in the groove is weighted to prevent the pin from being lifted out of the groove. This weight is simply a nickel-plated brass ball placed upon top of the pin. To measure an indicator diagram by this instrument the card *P*, is placed under the clamps as shown, with the space between the clamps which are set to correspond with the ends of the diagram. Place the tracing point *O*, at any place upon the line of the diagram. Turn the wheel so that the zero marks exactly coincide, then carefully trace the line of the diagram and stop at the precise point whence the tracing began. The reading upon the wheel will indicate the area of the diagram. Place the tracing point at the lowest line of the diagram at *D*, set the wheel at zero and move the tracing point up the edge of the clamp toward *A*, until the wheel indication is the same as the area of the diagram. This will give the mean width or height of the diagram, *A*, *D*, and measuring this distance with the scale of the spring will give the mean pressure of steam in the cylinder as represented by that diagram. It will be observed that this result is arrived at without the necessity of mental or other calculations of any kind. This instrument is made in two styles, one of which is furnished with and the other without a morocco case.

A Heavy Anvil Block.

Engineering mentions the casting of a 140 ton anvil block at Glasgow. The anvil is to be made of two blocks, weighing, complete, 165 tons. It is intended for a 12-ton steam hammer. The large block was cast in a mould occupying the position which it will eventually occupy after it has been slowly cooled, and has been canted over upon its proper base. The mixture used was about one-fourth No. 3 Gartsherrie pig iron and three-fourths scrap cast iron. Two cupolas were used in melting, each capable of melting six tons of metal an hour. Up to the present time there has been no anvil block in Scotland weighing over 140 tons.

Locomotive Notes.

SPECIAL SKILL WANTED FOR CERTAIN MACHINE WORK.

BY ANGUS SINCLAIR.

There is a peculiar elasticity of resort among Western machinists in their methods of achieving work without good facilities for doing it. Carlyle, or some other abstruse philosopher, asserts that the striking difference between the savage and the civilized man arises from the ability of the latter to handle tools. The crowning triumph of the Western mechanic lies in his striking ability to perform work creditably without tools. This is not the characteristic of all Western workmen, but it seems better developed there than anywhere else. Poor machinists are common enough in the West, but they do not generally pass muster as first-class men, for their shortcomings show out conspicuously where they are continually required to do work on their own judgment, without direction of gang-boss or foreman. Perhaps this is the reason why Western machinists, as a rule, are so persistently adverse to admitting that one machinist can be better than another. The progress of applied mechanics has a constant tendency to develop special skill on the part of workmen, in putting complex machines together, and in handling and repairing them after they are in operation.

There are machines and tools in every-day use that require master touches of refined skill at the hands of the fitter, and the exercise of rare ingenuity and judgment must be displayed in detecting causes of derangement after the machines have been at work. Yet it is quite a hard matter to convince the average machinist that the man who, by thought, investigation and study, has prepared himself to perform the delicate and difficult portions of shop-work is rightfully entitled to superior consideration, in the form of higher pay, than the common workman receives. Men who are otherwise sensible and considerate display no kind of liberality when such a case comes before them. All at once they become zealous for uniformity. When it is applied to the details of machine construction, uniformity is intensely desirable, but the spirit which attempts to reduce men's ability to uniform mediocrity cannot be too strongly opposed.

The work of railroad repair shops is extremely varied, and the greater portion can be done satisfactorily by men who possess no exalted order of mechanical ability. But, on the other hand, special work arises which calls for the highest order of dexterity, besides unerring judgment and keen sagacity. A complicated machine stops working, and has to be repaired. A tool gets out of order, whose anatomy is a mystery to ninety-nine out of one hundred machinists. Air pumps, hydraulic rams, pumps and jacks, steam hammers, pressure gauges, steam pumps, brake attachments, indicators, injectors, and kindred articles are simple enough in their mechanism to those whose daily work it is to put them together, but when such things get out of shape hundreds of miles away from the makers, and have to be repaired without delay, the man who proves himself competent to do the work is a valuable adjunct to a machine shop.

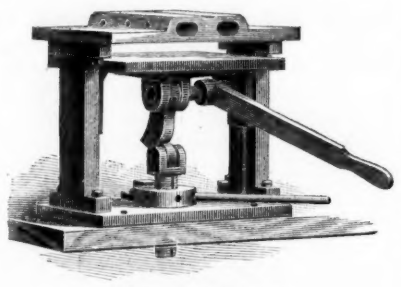
For the repairing of intricate machines and tools, essentials of machine shops, whose workings are imperfectly understood even among good machinists, special knowledge and special skill are requisite. An air pump comes in that is working indifferently, is intermittent in its action, and seems to pound the cylinder head. A machinist who can work as close as a mathematical instrument maker takes the pump apart, and can perceive nothing wrong. The pistons are all apparently in good order, the valves seem to be faultless, and the man can change nothing without the probability of doing more harm than good. Another man goes through the pump, and previous investigation and study of such machines give intelligent direction to his examination, and he quickly discovers that the trouble lies in the air valves having too much lift. Knowledge gave this man power. Knowledge and skill together have made him an expert in this particular line, and he is justly entitled to enhanced remuneration over the ordinary machinist, quite as much as the professional services of an accomplished oculist are fairly reckoned higher than those of an ordinary surgeon.

In railroad shops there is a constantly growing demand for machinists capable of doing the intelligent skilled work that is becoming so plentiful about air brakes, injectors, gauges, hydraulic apparatus and other special machines. And there is likely to continue an increasing ratio between the demand and the supply until improved means are taken to encourage machinists to prepare themselves to do this kind of work. Master mechanics, as a rule, are not any too anxious to recognize and acknowledge the true value of the services of men whose work is sometimes almost priceless, and they will generally keep the pay of the super-skilled man at the mediocre level so long as they can do so. This discourages the ordinary run of men from trying to acquire special mechanical knowledge. But the leading obstacle, to the proper recognition of special mechanical ability, lies in the reluctance of the trade to acknowledge special merit. Dog-in-the-manger sentiment is overwhelmingly dominant within the craft. Till something is done to eradicate or suppress this feeling the best friends of machinists will have continued reason to regret the apathy and want of ambition among the individuals themselves to excel in an important branch of their business.

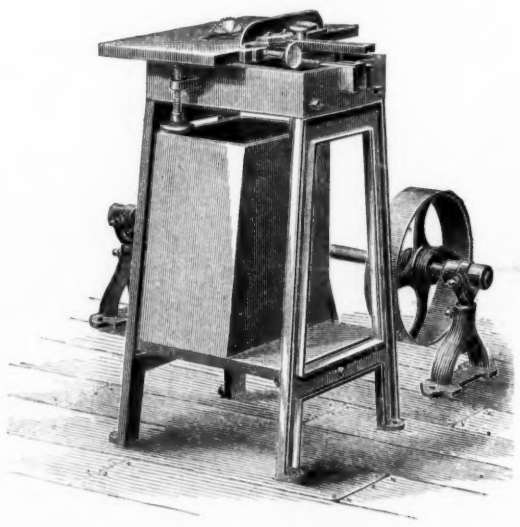
H. C. White, who has for some time past been in charge of the Westinghouse Machine Company's salesroom at Chicago, will shortly start for Arizona to superintend the erection of machinery built by the company, after which he will make, in their interest, an extended trip through Oregon and California.

Griswold's Saw Tables and Embossing Press.

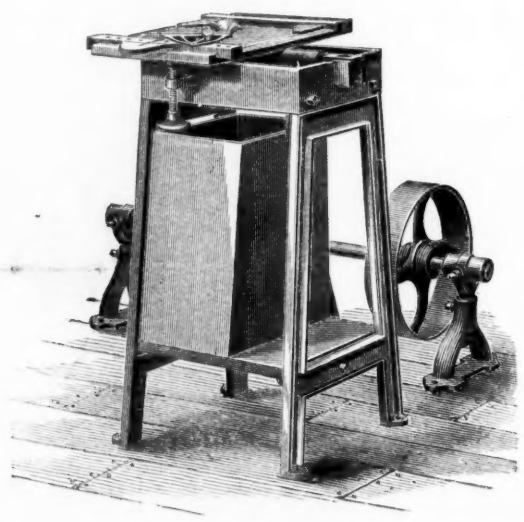
Two of the accompanying engravings represent two sizes of saw tables, made by George M. Griswold, which are now being introduced by Sweetland & Co., New Haven, Ct. These tables are intended for fine wood work of all descriptions. The frames are of cast iron, having a box or receptacle for catching the waste and sawdust. They are provided with various gauges and angle plates by means of which material may readily be cut to all desired angles. An elevating screw enables the operator to adjust the table at various heights. The saw mandrels are of steel having capped points hardened and ground before the arbors are finished, which insures a perfect balance and true running. The boxes are of babbitt metal in which the mandrels run on the cupped points. Saws are of an exceptionally fine quality, and are adapted for use of metal workers and may be used for ripping up sheet-brass and other similar metals. The size of the table is 11″ × 22″. Saws are 7″ in diameter.



EMBOSSING PRESS.



NO. 1 SAW TABLE.



NO. 2 SAW TABLE.

The other engraving represents a small embossing press, also made by the above named concern. It is of very simple construction, the table being adjusted by means of a nut and lever as shown. The operating mechanism consists simply of a cam and roller, which receive their motion from a lever. The table is 10″ × 12″.

A circular issued by M. N. Forney, Secretary of the Master Car-Builders' Association, says:

"The next annual convention of the Master Car-Builders' Association will be held in the Grand Pacific Hotel, Chicago, beginning at 10 o'clock Tuesday morning, June 12.

"Messrs. B. K. Verbryck, of the Chicago, Rock Island and Pacific Railroad, Chicago, and W. Forsyth, of the Chicago, Burlington and Quincy Railroad, Aurora, Ill., are the Committee of Arrangements, and should be addressed concerning hotel accommodations.

"Members are requested to send questions for discussion during the meetings to the Secretary before the above date.

"A meeting for the revision of the rules governing the condition of and repairs to freight cars offered for interchange of traffic will be held at 4 P. M. on Wednesday, June 13, at the Grand Pacific Hotel.

"The Exposition of Railway Appliances will be open in Chicago from the 24th of May to the 23d of June.

"This will be an additional inducement to lead master car-builders to Chicago, and it is, therefore, expected that there will be an unusually large attendance at the annual convention this year.

"Representative members are requested to be prepared to report the number of cars owned by their companies at the date of the meeting."

Value of the Art of Mechanical Drawing.

We make the following extract from the annual report of Director W. H. Thorne, of the Franklin Institute Drawing School:

"That the importance of some knowledge of the art of drawing is becoming more appreciated every year is evidenced by the annual increase in the number of students in this school. It is a promising sign, for there is no sphere in which the ability to express conceptions of beauty of form and design, or ideas of mechanical devices and constructions, by means of lines drawn on paper, in such a manner as to accurately convey these conceptions to others, will not prove of great value. The boy who attempts to make a bird-box will save time, vexation and material if he is able to plan it on paper, altering the design until it suits his fancy, and arranging the details and method of construction before he commences the work. So, the millionaire who is about to have a mansion built, if he is able to understand the architect's plans, can criticise, suggest alterations and devise conveniences which will place the stamp of his own individuality upon it and prove a source of just pride. To one engaged in a mechanical or industrial pursuit, a knowledge of drawing is coming to be indispensable, and those who do not possess it will inevitably fall behind in the race. To quote from the recently published autobiography of the eminent Scotch engineer, James Nasmyth: 'Mechanical drawing is the alphabet of the engineer. Without it the workman is merely a hand; with it he indicates the possession of a head.' It is of more or less importance in all pursuits, and that this is understood is shown by the number and the vocations of the students in our school.

"The number of students this year amounted to 402, of whom 210 attended the winter term and 192 the spring term. In each term the school was divided into seven classes, with an instructor for each class, and instruction was given four evenings in the week, instead of two, as heretofore, on account of limited accommodations. The progress made has been very satisfactory."

Milling Metals.

FROM A PAPER READ BY W. FORD SMITH, BEFORE THE INSTITUTE OF MECHANICAL ENGINEERS, ENGLAND.

There is a risk of fracture in making large milling cutters out of one solid cast steel blank, the principal difficulty being in the tempering. In practice it is found that if they are required of larger diameter than about 8 inches they are better made of wrought iron or mild steel discs, with hardened cast-steel teeth, so securely fitted into them that they do not require to be removed. The cutting edges can then be re-sharpened in their own places, as in the case of the ordinary milling cutters; thus insuring that each shall have the same angle of cutting and clearance, run perfectly concentric, and therefore do a maximum amount of cutting in a given time. It must, however, be borne in mind that the smaller the diameter of the milling-cutter, the better finish it will produce; and cutters of large diameters should only be used to reach into depths where one of smaller diameter could not. Again, the smaller the cutter the less

does it cost to make and maintain. The writer has not had an opportunity of actually testing the relative amounts of engine power required for driving milling machines; but as far as he can judge from ordinary practice in doing ordinary work, he has not perceived that any more power is required to remove a given weight of shavings than that required for a lathe, planing machine, or shaping machine with efficient cutting tools in all cases. The cutting speed which can be employed in milling, is much greater than that which can be used in any of the ordinary operations of turning in the lathe, or of planing, shaping, or slotting. A milling-cutter, with a plentiful supply of oil, or soap and water, can be run at from 80 feet to 100 feet per minute when cutting wrought iron. The same metal can only be turned in a lathe, with a tool-holder having a good cutter, at the rate of 33 feet per minute, or at about one-third the speed in milling. Again, a milling cutter will cut cast-steel at the rate of 25 to 30 feet per minute.

The increased cutting speed is due to the fact that a milling-cutter, having some thirty cutting points, has rarely more than three of these cutting at the same time. Each cutting point therefore is only in contact with the metal during one-tenth of each revolution. Thus, if we suppose it is cutting for one second, it is out of contact, and therefore cooling, for the succeeding ten seconds, before it has made a complete revolution and commences to cut again. On the other hand a turning tool while cutting is constantly in contact with the metal; and there is no time for it to cool down and lose the heat imparted to it by the cutting. Hence, if the cutting speed exceeds 30 feet per minute, so much heat will be produced that the temper will be withdrawn from the tool. The same difficulty to a great extent applies to the cutting tools in planing, shaping, and slotting machines. The speed of cutting is governed also by the thickness of the shaving, and by the hardness and tenacity of the metal which is being cut; for instance, in cutting mild steel, with a traverse of $\frac{3}{32}$ inch per revolution of stroke, with a shaving about $\frac{1}{8}$ inch thick, the speed of cutting must be reduced to about 8 feet per minute. A good average cutting speed for wrought or cast iron is 20 feet per minute, whether for the lathe, planing, shaping, or slotting machine.

Improved Cutting-Off Machine.

The cutting-off machine illustrated with this is made by Hurlbut & Rogers, South Sudbury, Mass. It is designed for cutting off stock from $\frac{1}{2}$" to $4\frac{1}{2}$" diameter, and when desired is provided with a centering attachment for centering the pieces. As will be seen, two cutting tools are used with this machine, the tool blocks being connected with a right and left hand screw. It is claimed that this is an advantage, in not only that two tools will cut faster than one, but that the pressure of one tool being diametrically opposed to that of the other, the strain and leverage on chucks and bearings is removed or neutralized. The ease and rapidity with which the tools cut are also increased by grinding one of them V-shaped and the other square across. By this means the V tool removes the stock from the center of the cut and the plain-ended tool from the corners, thus dividing the work and strain between two tools, instead of throwing it all on one.

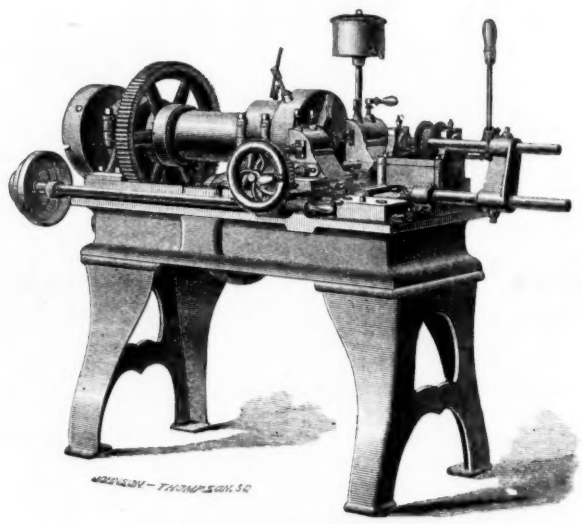
The feed screw is 7 threads to the inch, and the worm gear has 44 teeth, and it is guaranteed that in ordinary stock a feed of $4\frac{1}{2}$ revolutions of worm to one of the spindle can be maintained.

The cone pulley has four steps for $3\frac{1}{2}$" belt, the largest step being 14" diameter. The gears are cut from solid metal.

The countershaft is arranged with friction clutch and two changes of speed, giving to the spindle of the machine eight changes. The feed has automatic throw-off. Each machine is furnished with two "Slate" cutting-off tools.

The centering attachment is arranged to run from a separate countershaft. It is placed on a slide in front of the tool carriage, so that it can be pushed back out of the way when not in use. When in use it is drawn on the slide against a stop, and secured by turning a thumb screw. This stop is adjustable longitudinally, and the spindle frame is adjustable vertically, by being bolted to a wedge, so that the centering spindle can be brought at any time to correspond with the center of the main spindle, and rigidly clamped in place. The centering attachment is especially advantageous for shafting, or for heavy pieces, as they can be centered without rehandling.

The weight of this machine is 1,900 lbs.



CUTTING-OFF MACHINE.

Boiler Inspection and Management.

From an account of the proceedings at the recent annual meeting of the Manchester Steam Users' Association we take the following notes:

The chairman said that the association had now more members, more boilers enrolled, a larger revenue, a larger reserve fund, and had made during the past year a greater number of boiler examinations, than at any time since its foundation in the year 1854. It strictly maintained its fundamental principle of making an annual "entire" examination of every boiler, that is to say, an examination of the boilers inside and outside when at rest and prepared for the purpose. Without such examination no boiler was guaranteed, and no member who would not afford an opportunity for this was permitted to participate in the privilege of the pecuniary guarantee.

By strictly adhering to that principle the association was able once more to report that no explosion had arisen from any boiler under its charge during the past year, while it might be added that no life had been lost by any guaranteed boiler since the institution of the guarantee system in the year 1865, although during that period there had occurred, outside its ranks, as many as 791 explosions, killing 1,057 persons.

To the association belonged the distinction of being the first public body to establish on a practical working basis the system of independent periodical inspection, and also of being the first to procure a legislative enactment for preventing steam boiler explosions on land.

The Boiler Explosions Act, 1882, while it was in no way unduly hard upon the steam boiler user, was calculated to insure a more satisfactory inquiry as to the causes of steam boiler explosions, and thus to save life. No careful steam user could possibly object to the act. It did not in any way curtail his liberty, but left him absolutely free as to the choice of means, only holding him responsible for results. Boiler owners were more indebted to the Manchester Steam Users' Association for its attention to steam boiler legislation than they were aware. It had protected them from measures they would not by any means have relished.

A series of experiments was now being tried upon the Lancashire boiler to ascertain the effect of injecting cold water upon overheated, if not actually red-hot, furnace crowns. The furnace crowns had been bared and brisk fires allowed to burn, until the plates were sufficiently hot to freely melt a lead plate and other lead strips laid on the top of the furnaces. The plate and strips were loosely attached so that there was a film of superheated steam between them and the iron, and as they were rapidly melted the furnace crowns must have been much hotter than the melting point of lead, if not actually red-hot. Yet when water was suddenly thrown upon the furnaces, so far from there being an enormous quantity of steam suddenly generated, and the boiler rent in pieces according to the generally received opinion, there was no explosion, no rent, no collapse, and no movement of the boiler, while the pressure gauges were scarcely affected.

The question was forcing itself upon steam users as to the material of which boilers should be constructed, whether of iron or steel. The term "steel" suggested to the popular mind the idea of something hard and brittle, as for instance, a file, chisel, or other cutting tool. But there was steel and steel, one of the character just mentioned, and the other so mild as to bring it within the range of boiler construction, but possessing also other qualities which iron as a rule did not, notably homogeneousness. That quality was now leading to its use for furnaces, as it was not liable, like iron, to laminate. Lengthened experience seemed to show that steel, if carefully made, would gradually take the place of iron in the construction of boilers, especially if regard were had to the fact that ductility was of more importance than high tensile strength.

The question of smoke prevention, and the relative merits of mechanical and hand-firing, had been carefully considered by the Association, and the conclusions arrived at were that, as regarded economy, the two modes of firing gave practically the same results. As many as fifty-five mechanical stokers had been removed from boilers under inspection. To prevent smoke by hand-firing, nothing out of the common was wanted, but only a reasonably fair draught, a reasonably fair boiler, regular firing, and the admission of a little air above the firebars to secure the combustion of the gases. The air might be admitted either at the firedoor or at the firebridge. It was a good plan to admit the air at the firebridge in a constant stream through a number of openings having an aggregate area of about two square inches per square foot of fire-grate, and at the firedoor intermittently through openings having as nearly as may be an equal area.

The subject of incrustation was very important to the members. It was a good plan to introduce three pounds of soda ash per day to the boiler along with the feed water, but the soda should be good, and blowing out maintained. The investigations conducted by the Association for the last quarter of a century showed that the great majority of explosions were not due to the fault of the fireman, but to the fault of the boiler itself. Boilers were often worked on till worn out, and no thicker than an old sixpence. This was the fault of the boiler owner, and not of the boiler attendant, and the remedy was an examination of the boilers, and not of the stokers, as a bill before Parliament requires, as a means to prevent boiler explosions.

The Mining Engineers' Meeting, at Roanoke, Va.

The following programme of the meeting of the American Institute of Mining Engineers, at Roanoke, Va., has been issued by the secretary, T. M. Drown:

Monday, June 4th.

The opening session will be held in Roanoke, on Monday evening at 8 o'clock. Addresses of welcome will be made by Mr. J. B. Austin and Mr. Lucien H. Cocke, Mayor of Roanoke. Reading and discussion of papers.

Tuesday, June 5th.

Visit to Lynchburg by special train on the Norfolk and Western Railroad. On arrival at Lynchburg, a train, kindly provided by the Richmond and Allegheny Railroad, will take the party to the iron mines on the James River, at Riverville, and, if time allows, also to Stapleton. In the afternoon a session of the Institute, for the reading and discussion of papers, will be held in the hall of the Lynchburg Chamber of Commerce. Return to Roanoke in the evening.

Wednesday, June 6th.

Local excursions around Roanoke, visiting the Crozer Furnace, Upland and Houston mines, Rorer Iron Company's mines, and the Roanoke Machine Works. Evening session.

Thursday, June 7th.

Excursion to Pocahontas (Flat Top Coal Fields), and the Southwest Virginia Improvement Company's coal mines and coke ovens. Returning, the Ripplemead mines and Bertha Zinc Works will be visited. The night will be spent at Arlington or Bristol.

Friday, June 8th.

Excursion to the Cranberry Magnetic Iron Ore mines in East Tennessee, returning to Roanoke in the evening.

LETTERS FROM PRACTICAL MEN.

Effect of Emery Wheels on Mushet's Steel and Watch Case Springs.

Editor American Machinist:

I have been using some of Mushet's special tool steel, and have discovered something about it that I do not like or understand. It is this: After the tool is forged and allowed to cool, I find that it is quite hard; but after it is subjected to grinding on the emery wheel, and has become hot several times, it also becomes too soft on the edge—in fact, so soft that it can be filed very easily. I would like some of your readers who have more experience in using this kind of steel than I have to speak and tell us the cause of this.

There is also another little matter which has given me a great deal of trouble. It is the grinding of springs on an emery wheel I have often attempted to use the emery wheel in fitting case springs in watch cases, and whenever I have ground one on an emery wheel I have always had it break. No matter how soft the spring was, it would always come out the same. To make more sure that grinding on the wheel was the cause of the breaking, I have fitted a spring to a case with a file, and had it work all right; then have taken the spring out and ground off a little on the emery wheel where it would not change the strength of the spring. I then put it back in the case, and it would break the first time the case was closed. Now, how is this to be accounted for? I have also taken a dozen springs of good quality, and fitted them to a watch case by grinding on an emery wheel, and had every one in the dozen break the first time the lid was closed. The wheels I use are of two kinds, the tanite and the celluloid. Both of them, however, do the same thing. I run the wheels at a speed of about 4,000 revolutions a minute. The wheels are $\frac{1}{2}$" thick and 6" diameter. It may be that I am far behind the age in this matter, but if such be the case, I desire to know it. As it is, I am perfectly at a loss to know why the

simple grinding of a spring on an emery wheel should cause it to break.

W. S. HARRIS.

Croton Falls, N. Y.

The Balanced Valve Question.

Editor American Machinist:

In your issue of April 28, T. B. L. and Bert Baldwin, and in issue of May 12, W. V. White, take vigorous exceptions to the account of my experiments on balanced valves, illustrated in the AMERICAN MACHINIST of April 14. With reference to some of the notions expressed in these criticisms, I will offer a quotation from one who, if I were to mention names, would at once be recognized as first-class authority in the matter. This is in answer to my presentation of the case, and was fully appreciated by me, not only for its courteousness, but for the clearness of statement. Here it is:

"You may convince yourself of the potency of this film (speaking of a steam or vapor film between the valve and seat), if you will take two plates of iron and dress their surfaces together thus (referring to a pen sketch), say, 12″ square, and place them in a boiler, and connect one of them by a wire extending through the boiler to the outside by a small stuffing-box; then try what force is required to move the upper one when the boiler is cool and no pressure. This done, raise steam till the pressure is 200 pounds, if you please. This, without the presence of the film, would press them together with a force of 28,800 pounds. Now, to your surprise, it will take no more force to move the upper plate than it did when the boiler was without pressure."

The authority quoted is worth one thousand times all offered as yet, and is doubtless correct. But now to the application. A steam chest, with a valve covering nearly all the seat, leaving room for necessary play and clearance only, having no ports, with steam turned on at 40 or 200 pounds, would move as easily under the last-named pressure as under none, if this theory is correct, and it has doubtless been tested.

Now, suppose a hole—port, if you please—¼″ square, is opened; what would be the difference? And, again, suppose it was made 2″ square, or, if you please, 3″ square, what would be the difference? Would any more power be required to move the valve under pressure over one hole than over the other? We will suppose that the valve in the model, which is 4.44 by 5.5, covered a hole but a quarter of an inch narrower and shorter than itself; would the power required to move it be greater or less than over a hole ¼″ square?

All this for illustration, and to in some measure show how far astray the best of authority can go, and the very great difference in theories. The authority previously quoted, says, in speaking of the valve and ports—"the openings in face and valve from which the down pressure is derived"—showing, according to this, that his theory is that the pressure *on* the valve is due to the openings *in* and *under* the valve.

T. B. L. remarks that "while the valve is in motion the pressure is diminished inversely as the freedom of exhaust or back pressure on the piston is lessened, and the sliding of the valve, if seat and valve are in good order, and lubricated well, should not require more than 100 pounds pressure applied in direction of motion." (Theory again.) "If the valve represented in your engraving was reduced by an area equal to the area of the steam chambers under it, which can easily be done, and yet leave surface enough, I think, (guess again,) it would move as easily with the reduced area as with the full area and steam chambers with live steam in them," etc., etc.; and again: "With a valve pressure of 408 pounds as given, and a chamber or counter pressure of 402 pounds, we would certainly expect the valve to leak." The experiment was to test a principle, and less under pressure can be used to suit the case; 50, 70 or 90 per cent. of relief to the top pressure, or it can be turned off entirely. I will drop T. B. L. by saying that, doubtless, he is honest in his views, but there is altogether too much of theory in them. The authorities quoted and he seem to differ a little. According to that authority all the surfaces in contact are balanced by a "steam or vapor film," and only the holes or ports open to the atmosphere are to be considered.

But Baldwin comes in with another instalment of theory, a lot more of "I think so," and "it undoubtedly is so," etc. The more than once repeated statement that if there were no ports there would be no pressure must again be brought to the front, but as holes (ports) are opened ¼″ to 2″ or 3″ square, a change is evident. Why and how, is the question, and to the best of my knowledge no one so far seems to have taken the trouble to ascertain.

In Fig. 1 of Mr. Baldwin's effort he gives his theoretical lines and goes off in the same strain as T. B. L.

The pressure was proved by my experiment to be due to the opening, and not to the back of the valve, or plainer, to a line around the valve where in contact with the seat. "If there are no ports or openings there is no pressure." (My theory, if you please.)

Much surprise has been expressed by those well posted in steam matters at the facts demonstrated by steam turned into the testing model, and it has been presented to quite a number of experts.

What I have said about the effect of the ports should meet Mr. Baldwin's objections and illustrations, and it seems needless to say more about it.

It must be clear that his Figs. 2 and 3 are based on incorrect principles. In Fig. 4 his illustration is as much at fault as the balance. The oft-repeated statement that all is due to the ports renders his effort to make something out of his figure a failure, as every pound in the chambers *i* is so much relief to the valve. So many pounds pressure is due the openings, and making more surface does not add to the weight but to the area to support that weight, making it less per square inch. He finishes by saying: "I can see, judging from the illustration, April 14, that the model used in Mr. McGregor's experiments, not having a moving piston in it, or having an exhaust, steam working into the cylinder (from leaks or otherwise), would balance that portion over the ports; but if the steam were exhausted, the same as in a working engine, then the slide valve shown in the model would work harder."

It may be that my explanation of the test or model was not full, and I cannot blame Mr. Baldwin for my mistakes. The model, as previously stated, is half size of a 6½″ by 10″ portable engine, as perfect in all its details as possible, and fully up to usual practice in slide-valve engines. In order to ensure all (or as nearly so as possible) the conditions of an engine with a piston in it, running, a brass head was fitted into each end to and against the counterbore, with a gasket of rubber packing between them, and a set screw in the cylinder head to keep it in place at both ends, so that each end of the cylinder was as independent of the other as if a piston were in it.

Drip cocks were in the cylinder heads, which could be partially or fully opened, and in some measure even realize the effect of expansion in a cylinder with a moving piston. The exhaust was as perfect and correctly placed as usual in a slide valve; in short, nothing, in any respect, differed from a fully-rigged engine. The valve was worked regularly by hand. The machine was, as previously stated, got up to test a principle, and nothing was omitted short of a piston driving a shaft. I think this should satisfy Mr. Baldwin.

Now for Mr. White. The figures he gives are mine, but by some omission only part are presented. To say anything further in regard to the pressure on the valve, and to what it is due, would only be repeating what has been said; but in regard to the figures, to quote his remarks: "The second example is not dealt with fairly. The area of the ports is all right, but in the test the chambers open outwardly, as 'the cock *N* is wide open;' therefore, they must be counted as ports." This last clause is an error, possibly of mine; but, as it is such a glaring one in principle, I cannot but think it is a mistake of the printer. If *my* mistake, it is an exceedingly thoughtless one. The cock *N* was never open when the valve was weighed. This fact must explain to Mr. White why he is so far amiss in his figures. The cock was never opened only to pass off the drip caused by condensation in the chambers. Nothing but the eduction and induction ports were open—the first into the air, and the last into the separate and independent ends of the cylinder, under the same conditions as a working cylinder and piston.

In regard to the figures, he says "there is an error somewhere in the estimation of the area of the chambers," and for some reason a portion of them are omitted.

There are four small chambers at the *side* of steam chest and ends of ports—.875 (not 8.75, as in the article), by .19; their combined area is .6650. There are three in the middle of the seat. The two outside of the middle one are 1.1. by 2.625; the area of one of them, $2.8875 \times 2 = 5.77$. The middle one is 1.375 by 2.625, its area being 3.609 and $3.609 + 5.775 + .6650 = 10.049$. This is doubtless an oversight of mine. About this difficulty in getting the *stem* in the middle of the valve, I would say it was most carefully adjusted, yet may have been a little to one side. The value of that argument is, however, void, when the fact is considered that 408 pounds upward pressure, or lift by lever, raised the valve, and 10.049 square inches of chambers, with 40 pounds of steam in them, nearly balanced the valve. As more than once stated, the experiment was made to test a principle, which it did most thoroughly and to my satisfaction, but the model is no sample to build by or place the chambers by.

I cannot, in the light before me, for a moment entertain the theory that the pressure is due to the dimensions of the valve, but to the area of the openings to the atmosphere. There is a difference between them of 59 per cent., as only 41 per cent. of the weight due to the area of the back of valve was needed to raise the valve, not once only, but as often as it was tried. It may vary slightly in practice, but the principle is clear.

Dayton, O. THOS. MCGREGOR.

Lathesmen who understand the Problem of Screw Cutting Planer Graduations—The Dog Question.

Editor American Machinist:

With all deference to Chordal and to his interesting letters, I think he draws it hard when he says that only two lathesmen in twenty understand how to calculate gearing for screw cutting. Perhaps the class of machinists he has come in contact with has not been such as to give him an exalted opinion of their abilities. My experience of 25 years in New York and vicinity leads me to think differently. I should be inclined to say there were considerably less than two in twenty that did not understand the matter. If Chordal will visit the Delamater Iron Works he can find a lathe geared to cut a 6″ pitch, the leading screw of which is only ¼″ pitch. Furthermore, he will find that it does not puzzle the lathesmen to comprehend it. It requires a system of double compound gearing, and the matter is more difficult from having to use only the ordinary change gears. This train was correctly calculated by a good many lathesmen. I have also failed to find a planer hand who does not understand the relation between the different positions of work with reference to the planer table and the graduations for setting the head. I don't believe anything is gained by making the machinist appear materially worse than he really is. Nevertheless, I am satisfied that machinists should take more interest in publications devoted to discussing matters pertaining to the trade, as nothing will better serve to broaden their views and increase their understanding of things connected with it.

The worst class of men with whom mechanics come in contact is that class who, having but little knowledge of the trade, parade their superficial knowledge of books. Such men clamor for more pay on the strength of what they know, and contrive to breed discord generally.

I fully endorse Chordal's sentiments on the dog question. I have in my experience found but few shops in which there was not a loss, plain to be seen, from a lack of this important lathe adjunct. MACHINIST.

Result of Snubbing a Journeyman.

Editor American Machinist:

"DRUMMER" gives a point to some shop owners in your May 12th paper, about the way they treat some of the traveling agents that come round to sell goods, and I want to show up another side of the same subject.

The other day the boss let me off, for a little trip to the city, to see what was new in the market in the line of machine tools and shop supplies. Well, I dropped into a machinery sample-room (not the other kind)—one of these agency places—and a young man came up and wanted to show me around, or acted so. I had on a kind of cross in clothes, betwixt shop and Sunday, and when I said I was a machinist, down to the old man's, and was just looking around to see what was fresh, he didn't seem to think I meant him! At any rate, he didn't appear to take any more interest in my case.

Well, I looked around awhile, and pretty soon lighted on a new machine tool that I had just been reading about in the AMERICAN MACHINIST, and when I asked the price and some other little particulars, the young man came back out of the doorway, where he had been winking at some girls that were passing, and jerked out the price as he went into the office, and didn't seem to have any use for the other particulars. Just as I was leaving, pretty well disgusted, I heard one of the bosses back in the office ask the young sprig who I was, and Spriggy said: "Oh, he's nothing but a jour, looking round." When I got home, and told the old man about it, and told him that was the tool we wanted, he grumbled awhile at the price and then sat down and ordered one of the same make, but not from that concern, you may depend! And I notice the concern it came from has had most of our supply trade ever since.

Well, a few weeks after the tool was set to work, along comes a drummer from the first concern; and, who should it turn out to be but Spriggy, on his first trip! He recognized me right off, and when I showed him round where that machine was piling up chips, it was worth a week's pay to see his jaw drop. "Where did you get that?" says he. "Oh," says I, "we got that from a concern that thinks a man may be a jour, and still have a good deal of influence with the boss."

JOUR.

Back Pressure on Valves; Or the Equilibrium Line by Experiment and Theory for Broad Seated Valves.

FROM A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

By S. W. ROBINSON,
Professor Mechanical Engineering, Ohio State University.

The title of this paper perhaps poorly indicates its true import. More specifically, an attempt is made to determine by experiment what practical part of that pressure exerted upon the top surface of a valve by a fluid is required, when acting from below, to raise that valve from its seat. The valve is supposed to have a broad surface of contact with its seat, as in the case of a slide valve in the steam chest of an engine where the flanges have a broad lap.

Every designer of steam engines with slide valves finds the question asked of himself: "What force is necessary to slide the valve on its seat?" The first showing of an answer may be: "It depends on the pressure and the coefficient of friction."

Probably but little is positively known about either the effective pressure or the coefficiency of friction in this case. The present object is to throw light upon the question of effective pressure.

To illustrate, suppose a common *D* slide valve has a surface contact with its seat of

12″ × 12″ outside, less a 5″ × 10″ *D* cavity inside, as shown in Fig. 1, the cavity being supposed in communication with the exhaust.

It seems evident that the effective pressure is not $p_1 \times 12 \times 12 = 144 p_1$ where p_1 is the pressure in pounds per square inch, because why may it not be nearly the $p_1 \times 5 \times 10 = 50 p_1$ as due to the cavity itself?

The most thoughtful probably will assume some area between the inside and outside, in the neighborhood of that inclosed by the dotted line by which to multiply p_1 for the effec'ive pressure. This line I hereafter in this paper call the "equilibrium line," and the area inclosed within it the "equilibrium area," because the pressure p_1 multiplied by it, equals a force which, acting from below, will just lift the valve from its seat.

When the equilibrium area falls between that of the cavity and of the outside of the valve, it appears that the fluid pressing upon the top of the valve creeps under the edges to some extent, and that the film of fluid under the valve near the cavity relieves itself by escape into the cavity. It would seem from this reasoning, required for explaining the equilibrium line—that for true surfaces a film of almost infinitesimal thinness is constantly creeping along between the "contact" surfaces, towards the cavity; and that on this route, the pressure of the creeping fluid is continually falling, starting with that nearly of the higher pressure side of the valve, and ending at the cavity with the pressure of the latter.

When the whole lifting pressure exerted by the creeping fluid between surfaces is known, the equilibrium line can be located. The theoretical determination of this lifting action is the same as that for finding the force tending to throw a packing ring from its seat.

For a rectangular valve like Fig. 1, and for an incompressible fluid, the pressure falls on a straight line declivity, from P to P_2; p being the pressure just at entry, and p_2 that within the cavity. The fall from P_1 to p is due to the acceleration for entry into the space. The latter will be a small fraction of the whole, and it will be neglected here.

In Fig. 2 let the shaded area stand for a section through a *D* slide valve like Fig. 1, the square outlines being best for the present purpose.

If p_1 be the absolute pressure on the top of the valve, and p_2 the absolute back pressure in the cavity, then, according to what is said above, *EF* will represent the line of falling pressure from p_1 to p_2. Also it is evident that, if the area *IJKL* stands for the total absolute downward pressure upon the top of the valve, then the area *AEFC* will represent the total absolute lifting pressure at one side of the valve, due to the creeping fluid along *AC*, and tending to raise the valve from its seat. Now draw *EG* parallel to *AC*, and make the area *AEGH*= *AEFC*, then the lifting pressure of the creeping fluid neutralizes so much of the top pressure *IJKL* as lies directly over the length *AH*. Hence *H* is the position of the equilibrium line, likewise we may find the point on *BD*.

From the figure it appears that *AH* will equal a half *AC* only when $p_2 = O$.

As an example, suppose $p_1 = 60$, $p_2 = 15$. Then the mean pressure on *AC* is

$$P = \frac{p_1 + p_2}{2} = 37.5,$$

and

$$P + AC = p_1 AH,$$

or

$$AH = AC\frac{P}{p_1} = AC\frac{37.5}{60} = AC.625.$$

Hence the equilibrium line is nearer *C* than *A*. More specifically, it appears that 62½ per cent. of the pressure upon that part of the top of the valve which lies above *AC* and *BD* is counteracted by the lifting action of the creeping fluid.

This supposes the fluid incompressible like water (nearly so.) Hence the above calculation is suited to the case of a valve working in water. For quite a range of pressures under this case we may quote:

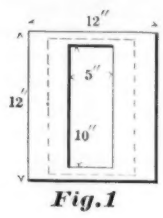


Fig.1

$\frac{p_1}{p_2}$	$\frac{P}{p_2}$	$\frac{P}{p_1}$	
2	1.5	.75	
4	2.5	.625	A
6	3.5	.583	
8	4.5	.562	
10	5.5	.55	

where p_1 is the absolute pressure upon the top of the valve, p_2 the absolute back pressure, and P the mean pressure due to creeping fluid. Then

$$A\,H = A\,C\frac{P}{p_1}, \quad \ldots\ldots\ldots (1)$$

thus locating the equilibrium line. If the fluid is elastic like air, and the flow in the space *A C* is adiabatic, we have

$\frac{p_1}{p_2}$	$\frac{P}{p_2}$	$\frac{P}{p_1}$	
4	2.72	.68	
6	3.94	.657	B
8	5.18	.647	
10	6.42	.642	

and for the isothermal flow of elastic fluids.

$\frac{p_1}{p_2}$	$\frac{P}{p_2}$	$\frac{P}{p_1}$	
4	2.80	.70	
6	4.09	.682	C
8	5.41	.676	
10	6.73	.673	

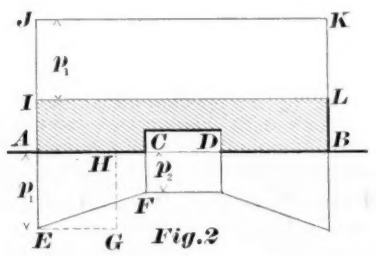


Fig.2

These tables differ but little, and values may be selected to suit any case in hand, including even a condensable fluid like steam, because, whether steam or water due to condensation fills the space *A C*, the case will fall within the tables above. If any exception is to be made on the supposition that with steam the percentage of water will increase on the route from *A* to *C*, it will be to the effect that the lifting force is greater than the calculation would give, and hence on the safe side.

To illustrate further the use of the above tables and formula, suppose a *D* slide valve in a steam or air chest is 10″ over all, and with a *D* cavity of 4″. Each flange will then be 3″ if equal.

Further, take

$$p_1 = 90.\ p_2 = 15.$$

Then

$$\frac{p_1}{p_2} = 6 \qquad A\,H = A\,C.682 \text{ or } A\,C.583 = 2.05'' \text{ or } 1.75''$$

if the last table be selected, or the first respectively.

Hence, doubling the values, we get for both flanges outside the equilibrium line

4.1 or 3.5″ respectively,

or within the equilibrium line

5.9 or 6.5″ respectively.

Hence the effective pressure of the valve upon its seat is as though the last named widths of equilibrium area only were subject to the pressure p_1.

THE EQUILIBRIUM LINE BY EXPERIMENT.

In the spring of 1881 Student J. H. McEwen subjected this question of back pressure to experiment in my mechanical laboratory, as a practical problem in course.

The appliance explained below was made by him for the purpose.

In experimenting, the data were procured partly by Mr. McEwen and partly by Mr. C. F. Marvin.

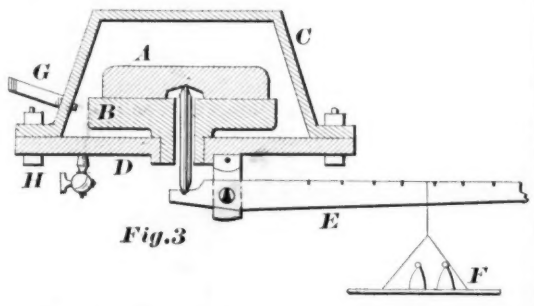


Fig.3

The results obtained from reducing the data to the valve are given in the plate. The appliance employed is shown in section in Fig. 3, in which *A* represents the valve, *B* its seat, *D* the bed-plate of the containing chest, *C* an inverted hollow piece, which, when bolted to *D*, together constituted the chest, *G* a nozzle for admitting the fluid pressure, *H* a cock for draining the chest, *E* a lever which by means of a strut reaching up through the seat will lift the valve *A*, and *F* the scale pan for loading the lever.

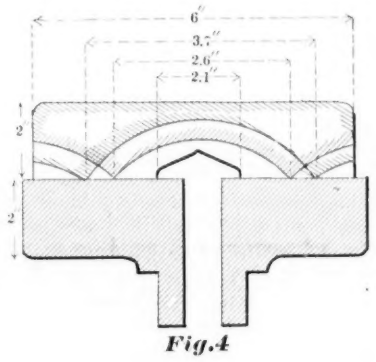


Fig.4

The valve and seat are circular in plan, and not rectangular. They were carefully fitted together by facing truly in a lathe, and then by grinding with emery. The grinding was done partly in the lathe and partly by hand with cross motion. It is perhaps to be regretted that this fitting was not done by scraping, but as they were, the surface possessed the properties of surface plates in a high degree. Placing *A* upon *B* with clean joints, the former would float upon the latter for five or ten seconds, lubricated by air. When settled, *A* would lift *B*, and support it for a considerable time. The surfaces were mirror-like for smoothness throughout. Though the job was well done for grinding with emery flour, yet it is believed that a somewhat more satisfactory contact could have been obtained by the scraper. The outside diameter of the valve *A* is six inches, and its cavity two and a tenth inches. The seat *B* was about three-fourths of an inch larger than *A* outside, with a central aperature of about one inch. This excess of surface on *B* was intended for insuring contact on the entire lower surface of *A*, even should it get eccentric with *B*. The seat *B* was mostly free from the bed-plate so as to relieve it from the strains and flexure of the latter. A neck projecting down from *B* was pressed into the bed *D*, with a free space between *B* and *D*, thus supporting *B* on a short leg. The strut from the lever *E* nearly filled the central hole in *D*, and extended to the bottom of the cavity in *A*. This cavity in *A* was made conical at the center so that the strut would always carry *A* concentric and poised, as it was raised. The thickness of *A* and *B* was about two inches. The lever was borne on knife-edges.

Steam was the only fluid experimented with. It was admitted at the nozzle *G*. Condensed water was let out at *H*.

In the experiments, weights were put on till the valve was raised, or, as in some cases, the weights were shifted along the graduated lever. The pressure of steam in the chamber upon the top surface of the valve was varied from 10 to 84 lbs. per square inch by gauge, or from 25 to 99 lbs. per square inch absolute. The results reduced to the valve are given in the plate where the circle dots were obtained by one series of observations, and the cross points by another, the two series being several weeks apart in point of time. The vertical scale at the left is for the steam gauge pressures in the chamber. The horizontal scale gives the number of pounds pressure per square inch of the cavity area, which was necessary to lift the valve. The figures given in this scale were reduced to the valve from the experimental data read off from the weighted lever, the weight of the lever, scale-pan, strut and valve being taken into account; but not the atmospheric pressure to which the cavity under the valve was exposed. Hence the figures in both scales are apparent pressures per square inch, one for the entire area of the six-inch circle of the valve, and the other for the area of the circle of the cavity, two and one-tenth inches in diameter.

The ') curve running among the dots is supposed to be drawn where the sum of the squares of all the distances from the line to the dots is the least, that is to say, that line is the probability line for all the observations, according to the theory of "least squares."

It is assumed, however, that the line should run through the origin.

From this line the figures in the first two columns of the following table were read off.

TABLE D.

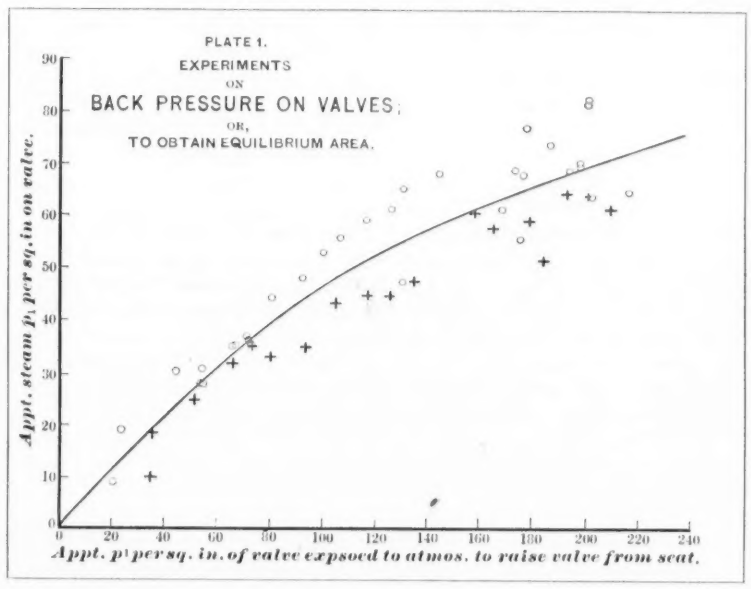
For a circular valve 6″ in outside diameter. with a circular cavity 2.1″ diameter exposed to the atmosphere.

Apparent pressure, pounds per square inch on valve 6″ in diameter. $p_1 - p_2$	Apparent pressure, pounds per square inch on cavity of valve, 2.1″ in diam. p'	Equilibrium area such that $a'(p_1 - p_2)$ will just raise the valve square inches. a'	Diameter of equilib. Area inches. d.
5	8.	5.6	2.6
10	17.	5.8	2.7
15	26.	6.0	2.8
20	36.	6.2	2.8
25	46.	6.4	2.9
30	57.	6.6	2.9
35	69.	6.8	2.9
40	81.	7.0	3.0
45	95.	7.3	3.0
50	112.	7.8	3.1
55	129.	8.2	3.2
60	150.	8.7	3.3
65	172.	9.2	3.4
70	198.	9.8	3.5
75	230.	10.5	3.7

A better notion of the quantities given in the table and plate perhaps can be obtained from Fig. 4, giving a section of the valve and its seat. Within the valve outline are drawn arching circles springing from the seat. These define the greatest and least equilibrium lines, which here are circles to the diameters 3.7″ and 2.6″ respectively, between which all the figures in the last column of the table fall.

The interpretation of Fig. 4 is this: For 75 pounds apparent pressure per square inch upon the top of the valve, the equilibrium circle is 3.7″ in diameter. That is, if the valve be taken from the chamber, and its seating face be turned off, or cut away with the exception of a sharp circular line to the diameter of 3.7″, so that when the valve is returned to its seat this circle is the only bearing of the valve upon its seat; then the same lifting force will be required to raise the valve from its seat as before, for this stated pressure of 75 pounds.

Again, when the stated apparent pressure is 5 pounds per square inch upon the top of the valve, then the same lifting force will raise it as when its face is cut away to a ring bearing of 2.6″ in diameter. In each case the atmospheric pressure is in full upon the cavity.



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NEW YORK, JUNE 2, 1883.

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A Problem in Machinery Manufacture.

As competition becomes sharper among machinery manufacturers, owing to a diminution of demand and increase in the aggregate capacity to supply, it will become a vital question with many establishments as to how cheaply well-made and substantial machinery can be produced. In standard machinery (like most machine tools), where patterns are seldom changed after suitable designs have been successfully placed upon the market, very few shops have adopted anything like the interchangeable system of manufacture. The few that have done so have an immense advantage over the others, which will become more apparent as competition increases. Some large and well-managed machine tool building establishments fix prices, as a rule, on all their productions, so as to obtain twice their actual first cost, both labor and material being considered. Again, some are content with a margin of twenty or thirty per cent., and still others, perhaps, hope to realize something like twenty per cent. when "all their improvements are completed," a time which is fondly anticipated from year to year. We know of one establishment, at least, building a machine tool of acknowledged excellence, and selling it at over $500, which costs less than $150, for labor and material complete. The work is let out to contractors in the shop, at $100 each, for everything required up to the boxing for shipment (castings as they come from the foundry being reckoned as material). Of course, the plant for such an establishment is more valuable than that of the old time-honored tool building works, but counting extra interest on investment, in addition to ordinary shop outlays, the profits are very attractive. The cheap production in this case (as in all other cases of the kind) is made possible by having an equipment of special tools for the particular work required. Not only small tools, but specially designed milling machines figure largely in the equipment.

If it cost sewing-machine manufacturers anything near what it costs machine tool builders for equal quantities of machine work, the housewife would have to pay at least four times what she does for a machine to stitch the family raiment. Yet the average sewing machine is better constructed than the average engine lathe. Special automatic machinery enables this to be accomplished

To build machine tools by a system of duplication of parts does not necessarily require a large plant.

The other day we were shown through a machine tool building shop by the proprietor who confines his efforts to two styles and sizes of machines, and has achieved a first-class reputation as well as a good demand for them. He informed us that he employs twenty hands, and that the average pay of the whole is just $8.50 each per week. But four are skilled machinists who are well paid, the others being workmen who are capable of feeding machines so provided with jigs and special tools that a mistake could hardly be made by any one of common intelligence. About the same class of help is employed in sewing-machine manufactories.

Of course, where a large variety of machinery is made the special tool and interchangeable system can be applied to but a small extent. But the problem of competing with establishments making but two or three sizes and styles of machines and equipped to do their work at a minimum expense by shops relying upon large capital and a great variety of productions is likely to prove more formidable than it has been.

The workmen in the little kingdom of Belgium are among those receiving the lowest wages of any in Europe. Not long ago it was proposed to erect grain elevators on the wharves at Antwerp. This created consternation among the laborers who are employed to do the elevating by the old-fashioned hand method. They were so afraid of being thrown out of employment by the introduction of machinery for elevating that they broke the windows of a meeting hall where the City Council was in session, discussing the chartering of a company to erect a steam grain elevator.

Perhaps verbal arguments will fail to convince these Belgian workmen that they cannot secure good wages while trying to compete by hand labor with workmen in other countries who are using machinery to accomplish the same results. It is certain, however, that the logic of events will crowd them into a practical acknowledgment of that incontrovertible fact.

English Machinery for America.

The London *Ironmonger* of April 28th, among its correspondence from Leeds, has the following:

In various classes of machine tools and cotton machinery a large trade is done from this district with America, but in both branches orders have of late been dropping off, and the new tariff is regarded with anything but satisfaction by the local tool-makers and machinists. Several of the former have a fair amount of work in hand, which is being pushed forward for completion before the new tariff, which will impose an additional duty of about six per cent., comes into force. Machinists have suffered considerably as the result of the new arrangement. In America there seemed to be an expectation that the duty on machinery would be reduced, and orders which otherwise would have been given out were held back. Now that the duty is to be advanced, buying from England has been virtually stopped, and, with the exception of a few special classes of looms which are not made in America, and which are being pushed forward for delivery before the end of June, orders have, comparatively speaking, ceased. Lancashire machinists regard the new tariff, which, with freight and insurance, will represent an addition of about 63 per cent. to the initial cost of the machinery, as practically shutting them out of the American trade. The actual alteration is an advance of 8 per cent. in the duty on the machinery, but this is accompanied by a reduction of 10 per cent on the packing. Col. Shaw, who has discussed the matter with some of the leading firms, considers this will, if anything, be slightly in favor of the English makers who ship heavy machinery requiring a great deal of packing; but for small machinery, with light packing, he admits the new arrangement may be against the English makers. The new tariff, he thinks, will practically leave the machine trade in much the same position as it was under the old arrangement. Last year three million spindles were put down in America, and he anticipates a similar extension this year. American makers not only are unable to supply the requirements for machinery in their own country, but they have not the skilled labor to produce the high-class machines made in England, which the Americans must have, and for which they will be compelled to give out orders to English makers.

The above is interesting, as indicating the probable effect of the new tariff on the English machinery trade with the United States, although the conclusion of Colonel Shaw that we have not skilled workmen in this country to produce as high-class machines as in England is pure buncombe. Most of our shops that purchased machine tools of English make while the boom was at its height would now willingly exchange them for American tools, and pay a premium for the privilege. We have not, however, heard of any machinery dealer who is ready to pay for second-hand imported tools much more than for equal weights of old scrap iron, although second-hand machinery of home manufacture, in good condition, commands fair prices as compared with new.

The fact, as above mentioned, that orders for English machine tools and cotton machinery from this country have lately fallen off, in spite of the 8 per cent. increase of duty which goes into effect July 1, very clearly indicates that cotton factories and machine shops on this side of the Atlantic, to use a slang expression, don't hanker for English machinery worth mentioning. It cannot be said that this lack of admiration or appreciation arises from ignorance of the qualities of the foreign article, for it has been sufficiently tried in this country to develop its merits.

Perhaps there are certain heavy machines that will be imported occasionally, for which there is too small a demand to induce any of our machinery manufacturers to construct, except when built to order. On the other hand, there is a growing demand for American machinery in Great Britain, as well as in other foreign countries, which our manufacturers are in better position to meet than ever before.

How to Break the Match Monopoly.

The revenue tax on matches ceases July 1, yet the match monopolists seem to be making great efforts to retain their absolute control of this industry. They absorbed, some time ago, all the leading match manufactories in the country. The same policy of absorption is being continued. While this monopoly was sustained by the United States Government it was practically impossible to break it. Now that competition is free (or will be in four or five weeks), it will be broken sooner or later.

The problem must be solved mainly by improved match-making machinery. The monopolists have, of course, covered all their special machinery by patents, but they have not secured all the inventors. The designing of improved match-making machinery is now a promising field for original mechanical skill. We have recently received several inquiries about match machinery, and have heard of several companies preparing to go into the business of making matches. One large one is now forming in Chicago, which, it is said, will start a factory in Connecticut. The monopolists will hardly be able to buy up every valuable invention applicable to match machinery, every new factory that starts, and all the timber land in the country.

How to Increase American Trade in Peru.

Vice-Consul Alfred Lapoint writes to the State Department of the United States, from Lambayeque, Peru, a letter which is printed in the Department Reports under the above heading, from which we extract the following:

I certainly believe that trade with the United States would enliven, should our manufacturers take the pains of sending samples, catalogues, and price-lists to some responsible merchants, and I may indicate that many consuls are authorized to be merchants, and I believe that their official capacity is a guarantee for them, besides having good references in the United States.

It is my duty to indicate that great carelessness prevails with our manufacturers; for instance, I was called upon to purchase in the United States a steam-pump and boiler, which I ordered from one of our most famed manufacturers, and when it arrived, not alone was the boiler inadequate for the pump, but actually after two months' work the upper tube sheet split in three parts, a proof of its bad quality and construction. It was so small that it could never run the pump more than two hours at a time and then stop to get up steam. The whole valley of Chiclayo was waiting to see the efficiency of the pump which was used for irrigating, to order some like it. The consequence is that through sheer carelessness on the part of the manufacturers, the orders will go elsewhere. The greater part of the planters that order machinery lack a knowledge of mechanics, and give their orders detailing the work they desire the machines to perform, and I recommend that great care and attention should be paid to this point, and avoid by thorough inspection the sending of useless articles, such as the pump alluded to.

It would seem that machinery manufacturers to whom such criticisms could justly be made to apply would not be establishments doing much business, either at home or abroad, but doubtless there are shops some of whose products go out to American consumers in something like this condition, without much attention ever being called to the defects. In this country mechanics who have skill enough to repair such defects in machinery are plenty, and in many cases, the machinery being paid for, perhaps, before the trouble is discovered, skill is called in and the trouble repaired without special complaint being made to the manufacturer. In a foreign country, like Peru, however, if machinery gives out or needs attention, it is not always easy to find mechanics who are qualified, and hence, the defective machinery being American, all American machinery is looked upon with distrust. Manufacturers who are looking for a foreign outlet

for their product cannot be too careful that every piece of work sent abroad is above suspicion.

Literary Notes.

REPORT OF THE PROCEEDINGS OF AN ADjourned meeting of the Master Car-builders' Association, held at Niagara Falls, October 10, 11 and 12, 1882.

This report contains the revised constitution and by-laws of the Association as adopted at this meeting; also reports and discussions on gauging wheels; form of wheel tread; screw threads; draw bars; car trucks; continuous brakes for freight trains; steel-tired wheels; standard journal bearings; journal-box and pedestal, and many other things of general interest. The discussions on these subjects are particularly valuable, as embracing the opinions of practical men thoroughly conversant with the subject and generally imbued with a spirit of progress. The report is illustrated with numerous engravings.

We have examined with some interest copies of *Science*, a new weekly journal, edited by S. H. Scudder for the Science Company, and published by Moses King, Cambridge, Mass. Before the new journal was issued it was announced that Prof. Bell, the telephone inventor, and a number of well-known scientists were to establish a paper which should reflect their views upon scientific topics and chronicle the advances which are being made from time to time in the various departments of science. The new paper is, however, too much devoted to the handling of abstruse topics and contains too many technical references and terms to be very interesting to ordinary readers. Doubtless professional readers will find much to interest them in its pages. In No. 14 issue (Vol I) we find an amusing illustration and description, taken from a French scientific journal, of a new form of vehicle for common roads, which strikes us as being considerably more scientific than practical. It may perhaps be best summarized as being in principle a cross between the Fontaine locomotive and the tricycle. No. 7 issue, in addition to containing a list of contributors, adds the unusual feature of publishing a list of the subscribers to the paper, numbering about 700 in all. This list contains the names of quite a number of distinguished individuals. The subscription price is $5 a year in this country and $6 a year abroad. Single copies, 15 cents.

Questions & Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(196) A. B., Taunton, Mass., asks: How can I case-harden malleable iron and steel castings? *A.*—Case-harden malleable iron the same as wrought iron. See answer to question 462, in the AMERICAN MACHINIST of Dec. 23, 1882. Steel castings can be hardened like ordinary cast steel.

(197) G. A. K., Birmingham, Conn., writes: We have a 10″ six-ply rubber belt (60 feet long) running over two 4 foot pulleys and two 18″ rollers, so that both sides of the belt come in contact with pulleys. What is the best way to fasten the ends of the belt together? *A.*—We know of no way better than by lacing.

(198) G. E. C., St. Louis, Mo., asks: Can I cut a screw with variable pitch, say ⅛″ in 30″? *A.*—If the pitch of your lead screw and the change wheels are regular, the pitch you cut will not be variable. By using proper gears you can cut a fraction of a thread more or less to any number of inches. It is doubtful, however, if, with the tools you have, you can make the change desired.

(199) A. P., Greenville, S. C., writes: Will you please tell me if the valve and pipes as given below are well proportioned: Dimensions of cylinder, 9⅛″x10″; revolutions, 100 to 110; size of steam ports, 3¼″x5⅝″; steam lap, ⅝″; size of steam pipe, 2″; size of exhaust pipe, 2¼″? *A.*—We should prefer steam ports not less than 8″ in length, and more steam lap, say ⅝″. The steam pipe we should make 2½″ and exhaust pipe 3″ diameter.

(200) J. M., Waterbury, Conn., writes: I am using plaster-of-Paris moulds, but am much troubled with what I call blow-holes. Can you inform me how to avoid this trouble; also how to get the moulds apart after drying, and should they be dried by the aid of fire? *A.*—It would be impossible to tell what the difficulty was without seeing the moulds. Quite likely the blow holes result from pouring too rapidly, not allowing the air to escape. If the moulds are artificially dried, it should be very slowly.

(201) T. W. H., Duluth, Minn., writes: 1. There is a discussion as to the following: A 25 lb. weight is suspended from the ceiling by a cord. What is the strain on the cord? This may seem like a simple question, but there is a difference in opinion. One party claims that the strain would be the same as one man pulling 25 lbs. one way against another pulling 25 lbs. the other way, on the same cord. *A.*—The strain will be 25 lbs. The strain on a rope with two men pulling 25 lbs. in opposite directions is also 25 lbs. If you have any doubt connect a spring balance in the rope and test the matter. 2. Will you please tell me how to mix Portland cement and sand to make a fire-hold floor over brick? *A.*—Mix from one to two parts sand with one part of cement. Let it dry slowly.

(202) J. W. S., Nashville, Tenn., writes: We have a suction fan 36″ diameter, running 1800 revolutions per minute. It gives us a good deal of trouble from heating and breaking of belts. Can I put a fly-wheel 30″ diameter, 2″ thick on the end of shaft to any advantage, and at what speed would it be safe to run such a wheel? *A.*—Unless there is some peculiarity about your arrangement we do not see what you would accomplish by the use of a fly-wheel on the end of shaft. The speed at which such a wheel can be safely run will depend on its construction, quality of iron, &c. We should not recommend to run any cast iron wheel 30″ diameter under the circumstances named at a speed of 1800 revolutions. If you think the use of a fly-wheel advisable, we should say make it 15″ diameter, and accurately balanced.

(203) W. S., Baltimore, Md., writes: I have a plain slide valve engine with single valve. The cylinder is 12″x14″, the engine running 100 revolutions per minute. The throw of the eccentric is 2⅜ inches. The steam ports are 1″; bridges 1 1-16 inches; exhaust port 1 15-16 inches. The steam lap of valve is ⅝″; exhaust lap 1-16″. What I want to ask is, if by making a new eccentric, or by other means, I can arrange to get better economy in the use of steam? *A.*—By doubling the steam lap on your valve, and increasing the throw of eccentric, to say 3½″, you would probably save a little steam. You should first determine, however, if there is room in the steam chest to admit of this. If your engine is otherwise in good condition, a better plan still would be to have some reputable steam engine builder put an adjustable cut-off on the back of main valve. If your engine is fairly loaded at the present speed we should suppose there would be no trouble in increasing the speed until it would do the work of cutting off at about ¼ stroke.

Business Specials.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

James W. See, Consulting Engineer, Hamilton, O.

A. Wilkinson, expert steam engineer, Manayunk, Philadelphia, Pa.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, 25″ lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

H. E. Penney, manufacturer of Steel Spring Cushioned Helve Hammers. Photo and circular on application. Minneapolis, Minn.

How to reach 40,000 prominent "*Steam Users*" in the United States. Send for our circular. The J. N. Mills Publishing Company, 145 Broadway N. Y.

New tool chest, price $10. See description in AM. MACHINIST, April 14th, or send for circular. Goodnow & Wightman, 176 Wash'ton st, Boston, Mass.

Speed and drill lathes, 10″x4′, new design. Self-clamping rest, first-class material and work. Parties about to buy will do well to inquire. C. Wing, Greenfield, Mass.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

We will pay 25c. each for copies, in good condition, of the issues of January 1st and January 8th, 1881. Those sending us either of the above dates will kindly write their name and address on the wrapper for identification. AM. MACHINIST Publishing Company, 96 Fulton street. N. Y. City.

Cheapest, strongest, most simple, compact, durable, effective and economical steam pump in the market, for raising liquids under and up to 100 feet. No machinery, no oil, no special care. Can be worked suspended by a chain. Pulsometer Steam Pump Co., 83 John street, New York.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

For sale—First-class heavy-built rock shaft engine, 16x36, built by Kemp & Falconer, in good order; 12-foot band wheel, 22 inch face. Two boilers, 4′x26′, all fittings complete; two 15″ flues in each boiler; ⅜″ shell. Also, four Boomer & Boschert presses, jacketed tank. Wright Walter, 541 West Thirty-fifth Street, New York.

For a strictly first-class automatic engine, from 10 to 60 horse-power apply to the Straight Line Engine Company, Syracuse, N. Y.; medium or high-speed; perfect balance; fewest parts and fewest working joints; uniform speed at all ranges of power or steam pressure; the best material and workmanship in all vital parts; the most correct distribution of iron; unexcelled in smooth running.

Now ready for delivery, volume 5 of the AMERICAN MACHINIST, comprising the year 1882, (52 issues) complete with index, in substantial book form Also a few remaining of volumes 3 and 4 comprising the years 1880 and 1881, can be sent anywhere by express. Price of each volume, $4.00; express charges to follow. AMERICAN MACHINIST Publishing Company, 96 Fulton street, New York City.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Manufactures.

The White Machine Company, Waterbury, Conn., are now running 13½ hours a day to fill orders.

The Ætna Match Company has organized at Southington, Conn., with $30,000 capital. R. A. Neal, president.

Selma, Ala., proposes to have a $50,000 bagging factory, a large part of the money having already been promised.

Julius Bindrim, stone yard, 476 Flushing avenue, Brooklyn, is about to put in an engine and boiler of about 50 H. P.

Jonathan Cornell, of Sandy Hill, N. Y., is about to erect an iron foundry to be used in connection with his machine shop.

The Houchin Manufacturing Company, 26 Warren street, New York, are about to put in a new engine and boiler of about 15 H. P.

F. Armstrong, manufacturer of stocks and dies, Bridgeport, Conn., has nearly finished his new shop, 150x75 feet, four stories high.

Henry Schlade is building a new factory for silver-plated ware in Ainslie street, Brooklyn, N. Y. His office is at 84 John street, New York.

The Black & Clawson Company, Hamilton, Ohio, are building a new iron foundry, 140x40 feet. Their specialty is paper mill machinery.

The Winchester Arms Company, of New Haven, Conn., are at work upon a contract for 250,000 Hotchkiss rifles for the Chinese government.

There is forming in Chicago a large joint stock company for the purpose of making matches. It is said the factory will be located in Connecticut.

The Western Engine Works, Marshalltown, Iowa, Geo. H. Beebe, proprietor, make seven sizes of high speed upright engines with patent single cross-head. Orders are abundant.

The Cummer Engine Company, of Cleveland, O., will soon break ground for the new additions to their works, which additions will comprise new boiler and pattern shops.

The Morse Bridge Company, Youngstown, O., is putting into their works some additional heavy machinery, which will largely increase their capacity for executing contracts.

The Pratt & Cady Company, Hartford, Conn., are building a new machine shop and brass foundry, 150x100 feet, two stories high. It is near the shops of the Pratt & Whitney Company.

According to the *Denver Journal of Commerce*, the nail works at South Pueblo (Col.) are unable at the present time to supply the demand upon them for nails. More machinery will have to be added.

The International Tile Company, composed of English capitalists, are building a factory in Third near Smith street, South Brooklyn, N. Y. It will be about 100x60 feet, with a smaller building for kilns.

The *Baltimore Manufacturers' Record* says: "The large majority of city manufacturers report business as picking up considerably; spring orders coming in very fast, the lull in business having been succeeded by great activity."

The Long & Alstatter Company, Hamilton, Ohio, are getting out a new illustrated catalogue of their machinery, including punches, shears, trip hammers, and railroad shop heavy tools. They will make a full exhibit at the Chicago Railway Exposition.

Steps are being taken to organize a sewing machine factory company in Atlanta. Mr. James Shipp, of New York, has a patent. J. C. Peck, R. J. Lowry, F. G. Hancock, T. Healey, Mr. Van Winkle and others are in it. The capital will be $300,000.

The stockholders of the Palmer, Mass., Wire Company have voted to increase the capital stock from $100,000 to $150,000, the original stockholders having the privilege to take the new at par. The company is overrun with orders and the mill is busy night and day.

Watts, Campbell & Co., Corliss engine builders and general machinists, Newark, N. J., have issued a new descriptive catalogue of the Corliss steam engine, which is calculated to give information to those using steam power. The catalogue is sent free on application.

At the Sandy Hill (N. Y.) Brass and Iron Works business is so pressing that a portion of their employees are working night and day. The regular hands work no less than twelve hours, and the orders received by the establishment indicate a continuance of such successful business.—*Sandy Hill Herald.*

The rubber works in the Eastern section of the country have resumed operations after several weeks' idleness. The cornerers of crude rubber had forced the price up from 97 cents to $1.24 a pound. It had declined to $1.15 when the mills started up again. One factory, that of L. Candee & Co., New Haven, Conn., employs 1,400 operatives.

The various patents controlled by Clem & Morse, the Philadelphia elevator builders, have so increased the popularity and demand for their elevators that the firm has been compelled to increase its facilities by taking the four-story brick building, No. 411 Cherry street, which has been altered to communicate with No. 413, the building heretofore occupied by them.

A new cotton factory will probably be erected in Oakland. Subscriptions to the capital stock are now being made in San Francisco and Oakland. It is purposed to be named the California Cotton Mills Company, and the capital stock is intended to be $600,000, divided into 6,000 shares of the par value of $100. In San Francisco 2,000 shares have been subscribed. E. C. Sessions has offered to donate a site.

The Ashcroft Manufacturing Company, 111 Liberty street, New York, has received an order for all the steam and vacuum gauges and counters for Jay Gould's new yacht Atalanta; also gauges, &c., for several other ships building by Cramp & Son. They also furnished the engine-room fixtures, including steam and vacuum gauges, counters, clocks, and indicators for James Gordon Bennett's yacht. They report the sale of Tabor indicators constantly increasing, and that they cannot keep up to their orders for them.

The projected shops and freight yards of the New York, West Shore & Buffalo Railroad Company at East Frankfort, N. Y., will cover between 150 and 200 acres of ground on both sides of the track in East Frankfort, which is between Ilion and Frankfort, and within nine miles of Utica. The freight yard will have space for 25,000 cars and engines. The first building on the east will be the blacksmith shop, 300x70 feet; next, the boiler house, 70x35 feet; next, the boiler shops, 312x70 feet; the carpenter and pattern shop, 200x50 feet; the pattern storehouse, 50x40 feet; the foundry, 300x70 feet; the machine and erecting shops, 319x110 feet, and last of the principal buildings, the office of the company and drafting apartments, in a building 150x45 feet. The paint shops and other buildings are nine or ten in number. The total length of these shops, as planned thus far, will be nearly half a mile; 1000 men will be employed, and the shops are expected to cost $250,000.

The *California Architect and Building News* says: "During the year 1882, there was at times a decided lack of skilled labor in all branches of mechanism in San Francisco, and at no time a surplus of good workmen; so much so, that sign-boards posted on buildings, 'Carpenters Wanted,' and on workshops, foundries, machine shops, etc., 'Hands Wanted,' were of common occurrence; and as an inducement, extra wages were in many cases offered. The brick-laying forces were also inadequate for the labor purposes of 1882, and but few jobs were carried through on time. With such a state of things prevailing during the past year, what may be expected for 1883, with the showing already made in these columns, of a threefold increase in the amount of building contracts let during the first quarter of 1883. We hope that among the thousands of new-comers to this State, there are a goodly number of first-class mechanics, all of whom will find ready employment. This shortness of labor supply is not confined to building mechanics, but extends to nearly if not quite all other classes of skilled labor. From inquiries among the machine shops, boiler makers, glass cutters, and others, we learn that the same condition of things exists, especially so far as *competent* workmen are concerned.

Machinists' and Engineers' Supplies.

NEW YORK, May 17, 1883.

The supply business continues of small proportions, and there is a great tendency to cut prices to get orders. This unsettled state of the market will probably continue for some time.

J. M. Carpenter, Pawtucket, R. I., has just brought out an improved die stock, which is supplied by all the leading dealers.

The pig iron market is quiet with a light demand, and a prospect of still lower prices before the market becomes settled, the labor troubles adjusted, and confidence restored. We quote prices as follows: Foundry No. 1, $22; foundry No. 2X, $20; Grey forge, $19 to $19.50. Foreign iron is in light demand, with prices unchanged. Scrap is dull and weak. Rails are quiet but steady. Old rails nominal. Copper is quiet but steady at 16c. for Lake Superior. Banca tin, 22c. Straits and Malacca, 21⅜c. to 21¼c. Billiton, 21⅜c. to 21¼c. Australian, 21¼c. to 21⅝c. Spelter, common, domestic, 4¾c. to 5c. Refined, 8c. to 8¾c. Lead, 4.45c. to 4.50c. Antimony, Hallett's, 9.70c. Cookson's, 10.70c.

In giving the address of the Gray Belt Shifter Company in our issue of May 26, 1883, we should have given the number of Post Box 1020, instead of 438.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted, a good pattern maker, at the Salem Iron Works, Salem, N. C.

Wanted—Ten first-class machinists, to work on wood-working machinery. Address, Box 3, AM. MACHINIST.

Wanted—Situation as pattern-maker, by a man competent to take charge of shop if desired. Address C., care of AM. MACHINIST.

Wanted—Situation by a designer and draughtsman, who has had shop experience. Address William, care of AM. MACHINIST.

Wanted—Position as foreman, by competent machinist. Manufacture of specialties preferred. No objection to country. Address B. B. Hough, 1009 Elm street, Wilmington, Del.

Wanted—Position as draughtsman and designer. Have held positions of draughtsman, foreman, and superintendent of machine-shops. Thoroughly competent to design and execute. Marine work preferred. Address W. G., BOX 2, AM. MACHINIST.

Wanted—Traveler on engines, boilers, iron and wood working machinery, and machinists' supplies; must be posted on prices and discounts. Give references and salary expected. Address, Machinists' Supplies, AM. MACHINIST office.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.

Machinery wanted—Second-hand engine lathes, 18″ to 30″ swing 10′ to 20′ beds; state size, condition and price, and where they can be seen. Address "Machinery," AM. MACHINIST.

Wanted—A second-hand propeller condensing engine, cylinder 30″ diameter or thereabouts. Address, stating size, maker, price, and where it can be seen, Engineer, care AM. MACHINIST Publishing Co.'s office.

Machine shop for sale—A shop with good machines for any machine work. In New England. Price, with lease, $2,500. Rent of room and power only about fifty cents per day. Steam power. A splendid chance to get a good shop cheap. Address "Henry," care AM. MACHINIST.

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189 & 191 Front Street, New York,
MANUFACTURERS OF
Machinery, Engine, Cylinder, and Tempering
OILS
Samples Submitted Free. Established 1822

COOKE & CO., DEALER IN

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22 CORTLANDT ST.,
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AGENTS FOR THE
Greenfield Vertical Engines
2½ to 30 Horse Power.
Unequaled in workmanship and quality of material. Prices lower than any other first-class engine.
ALSO
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

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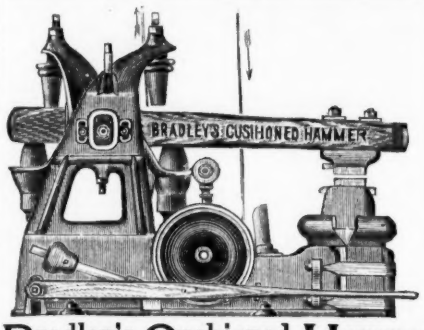

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Stands to-day WITHOUT AN EQUAL.
OVER 800 IN USE.
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6 in. and 8 in. Hand and Power.
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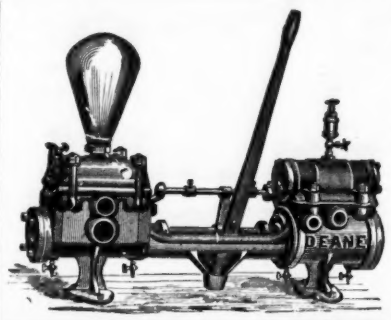
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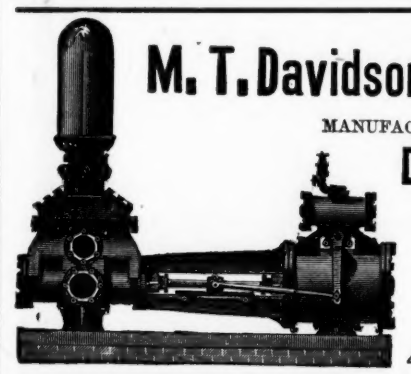
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Warranted the Best Pump made for all Situations.
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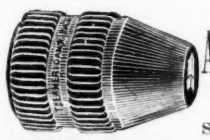
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Sold by all Tool Dealers.
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Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.
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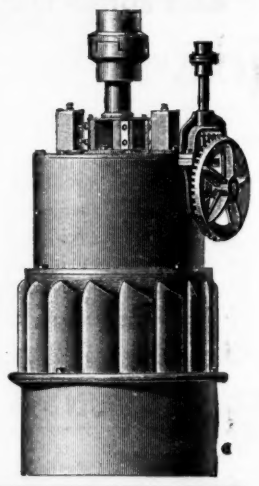
Send for Catalogue, Circulars and Price List to either of the above places.



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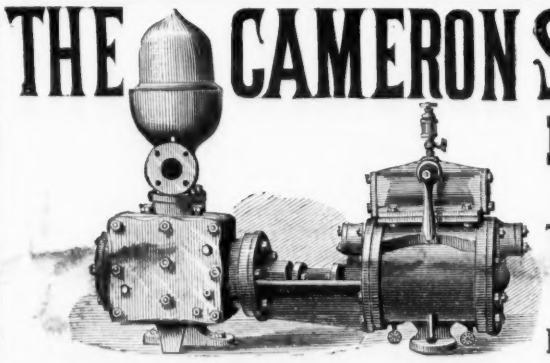
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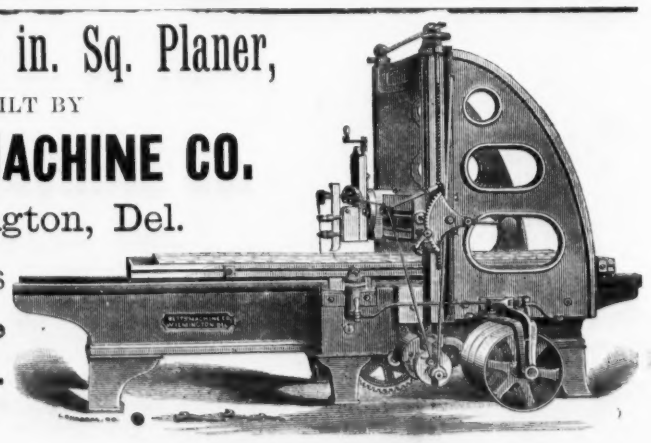

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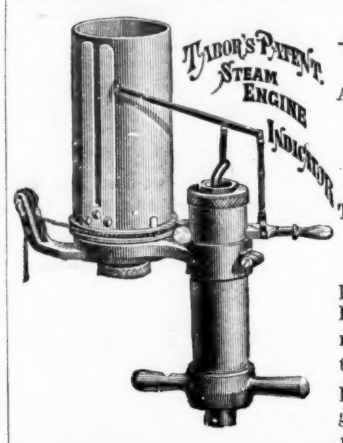

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Tabor's Patent Steam Engine Indicator.
AMOS WHITELY, Pres't. CHAS. A. BAUER, Sup't.
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You ask me "How I am pleased with my pair of Tabor Indicators." In reply would say that I have *tested* and *inspected* them *thoroughly*, and am now more than pleased with them. The workmanship is the *best* I ever saw. I consider the instruments about perfect. You certainly have given the Indicators a great deal of attention, to bring it to such a state of perfection. Yours very truly, CHAS. A. BAUER.

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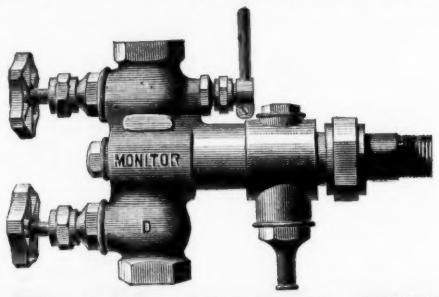

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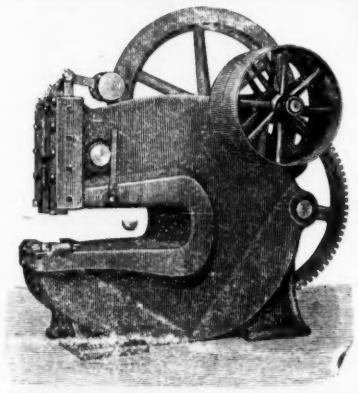

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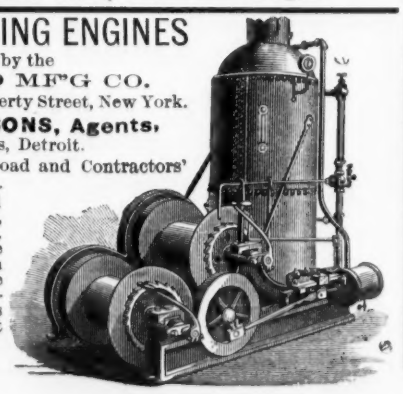

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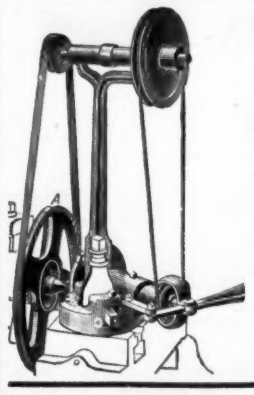

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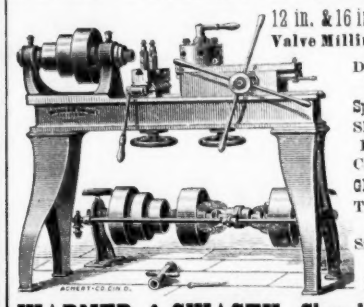

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With Steel Screws. Lathe Made and Hardened.
This dog is very heavy, and is warranted not to break with any work

No. 1	3-8 in.	$	.50
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" 11	1 3-4 "		1.25
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Full set, 19 Dogs, 26.35
No. 20 .. 5 1-2 in. .. 4.25
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When ordering, state as above, whether a full set or a set of 12, or small set of 8. Users of these dogs prefer them to any other make.

No 1	3 8 in.	$	.50
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Small set of 8 dogs from 3-8 to 2 in., $7.30.
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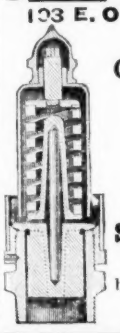

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These Valves have been approved by U. S. Government.
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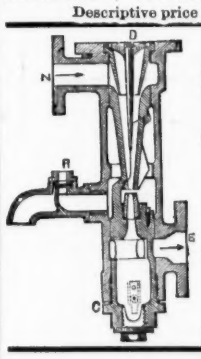

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Worked by Exhaust Steam Alone.
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UTILIZES A POWER HERETOFORE THROWN AWAY.
Works automatically at a steam pressure of less than half a pound. Adapted to all pressures.
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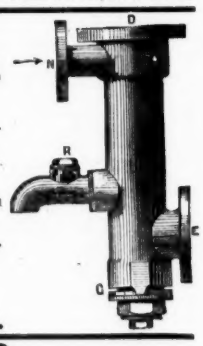

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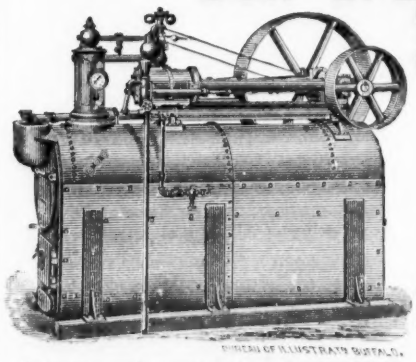

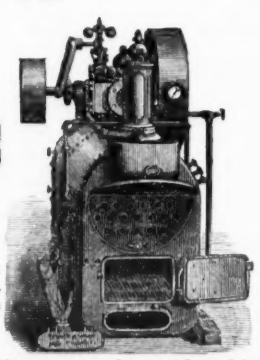

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No Boiler. No Coal. No Steam. No Ashes. No extra Insurance. No Engineer. No Danger. No Explosion. No Fires. Almost no Attendance.

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Pumping Engines
AND
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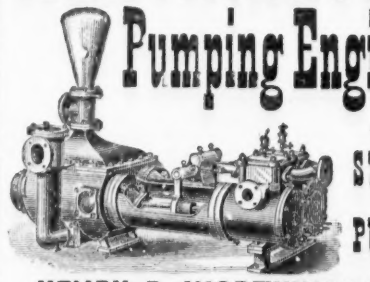

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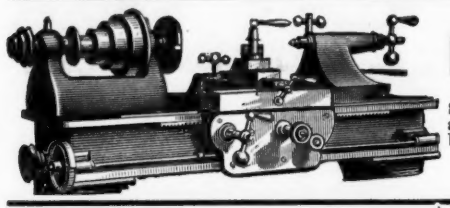

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Hollow Spindle, Improved Stop Motion, 14 inch Swing 4 to 8 feet beds. Also, 5 foot **Hand Lathes**, and **Engine Lathes** with screws and back gears, or back geared lathes without screw. Send for circular.

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14" ENGINE LATHES OF NEW DESIGN
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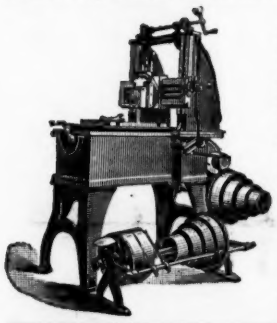

Planes 16 inches high and wide, and has 12 inch stroke.
It has power, cross and angular down feed as shown in cut, or cross feed only, if desired.
Also, quick return motion and screw running whole length under bed.
It is self-oiling in its ways.

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They are not **Horton Chucks**
UNLESS OUR TRADE MARK

"The Horton Lathe Chuck,"

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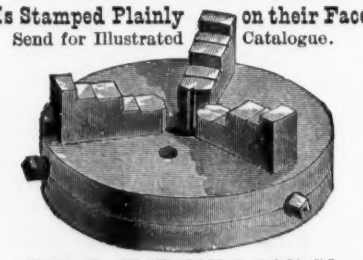

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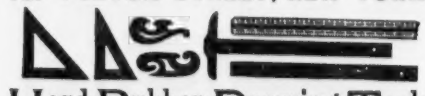

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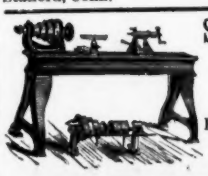

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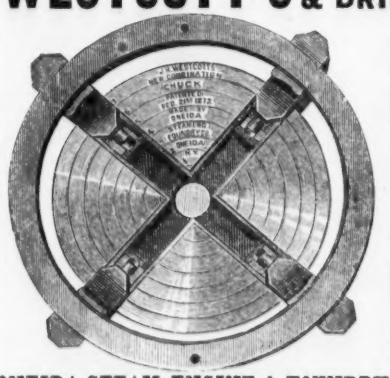

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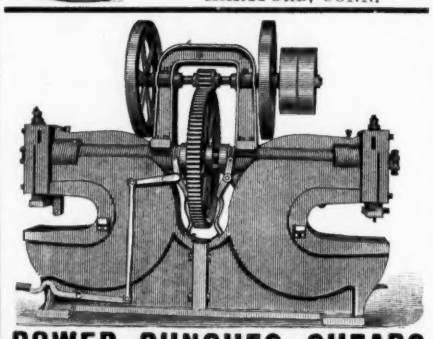

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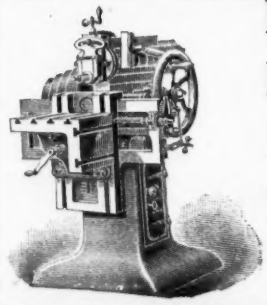

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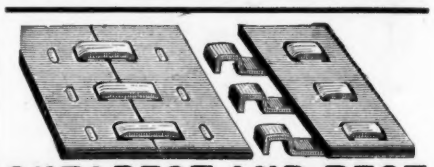

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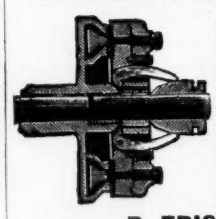

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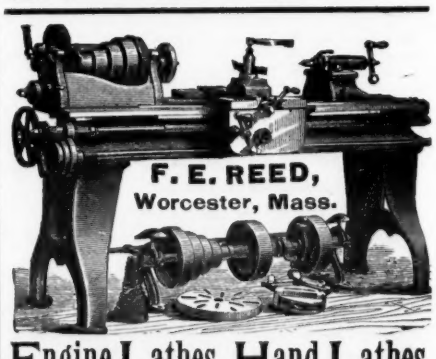

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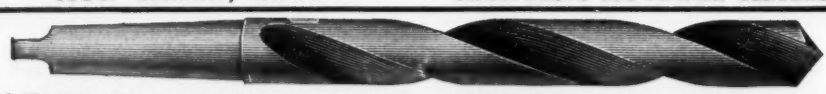

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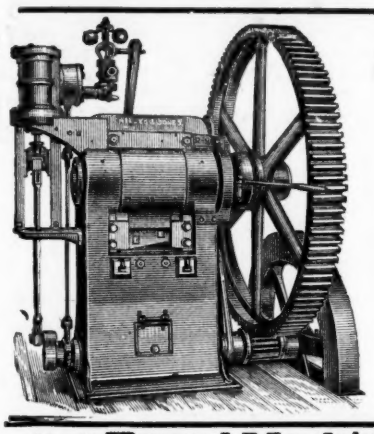

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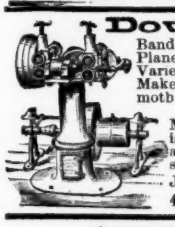

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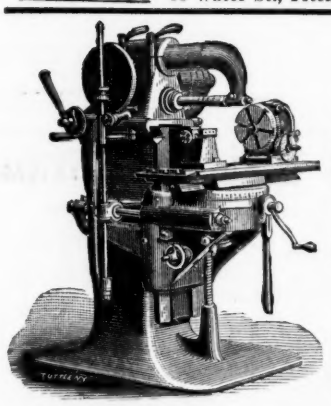

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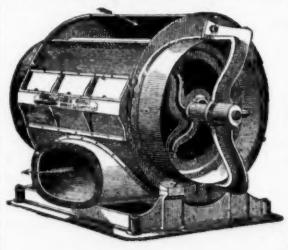

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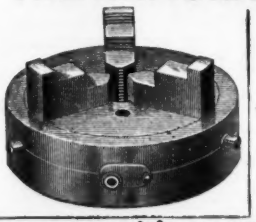

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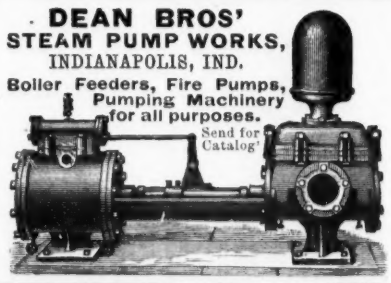

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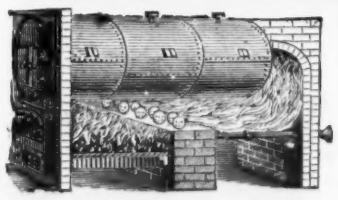

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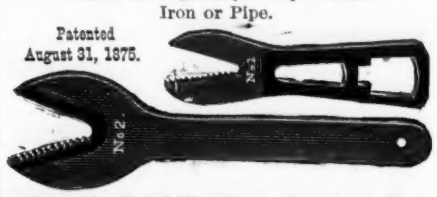

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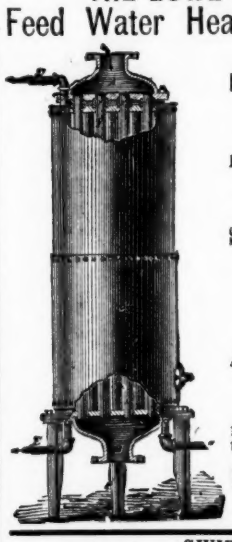

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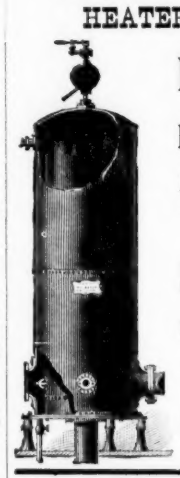

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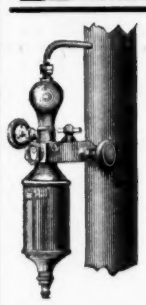

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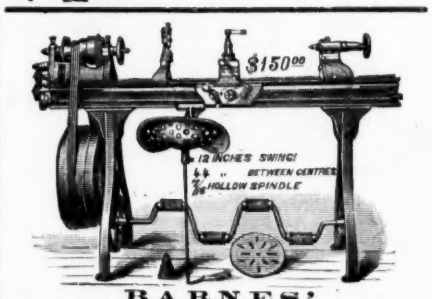

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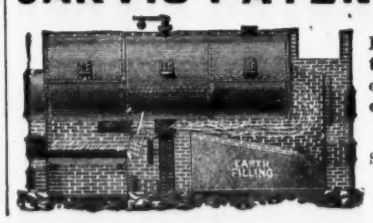

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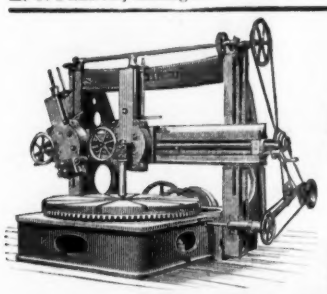

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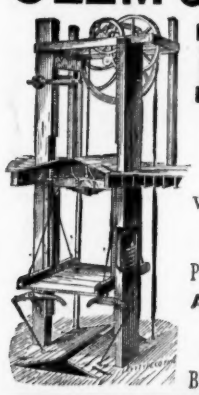

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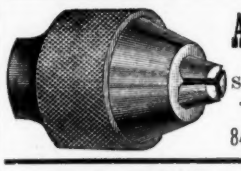

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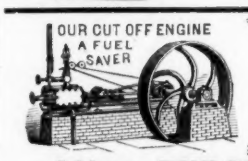

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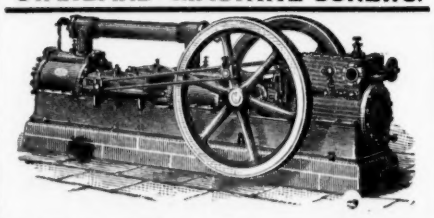

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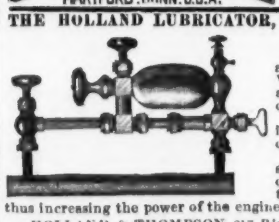

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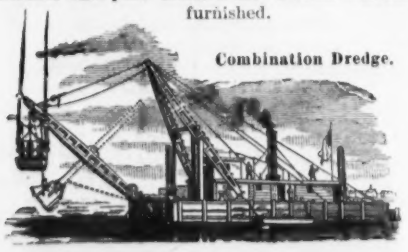

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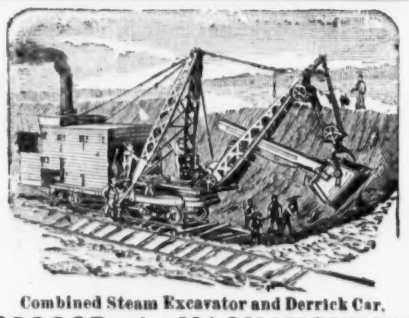

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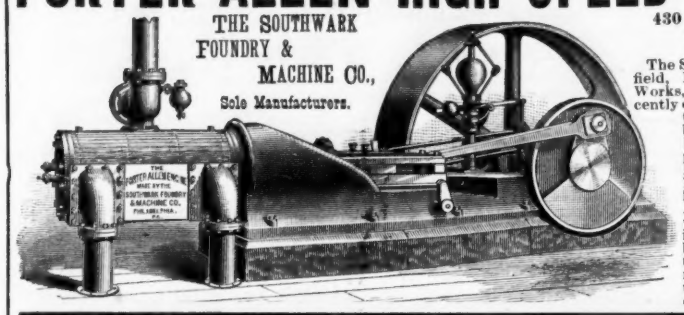

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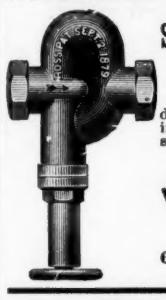

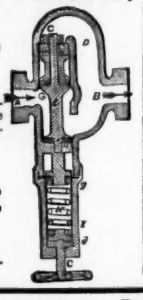

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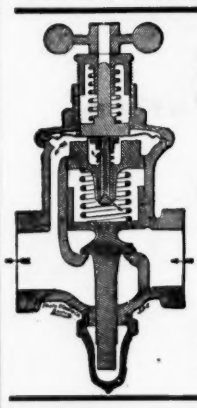

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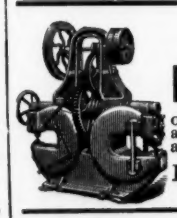

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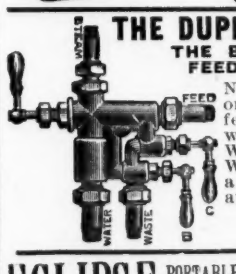

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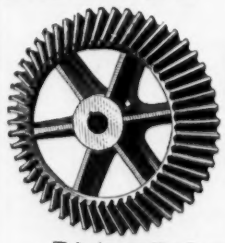

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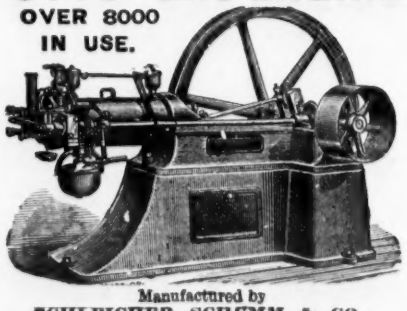

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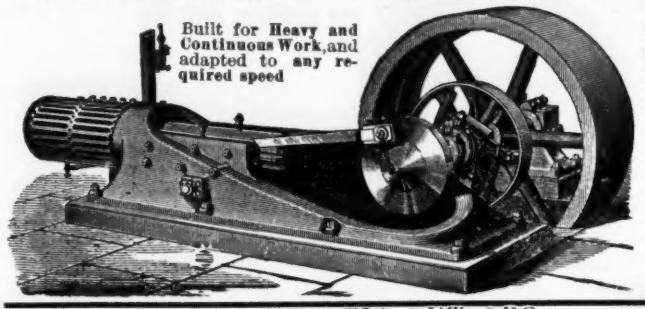

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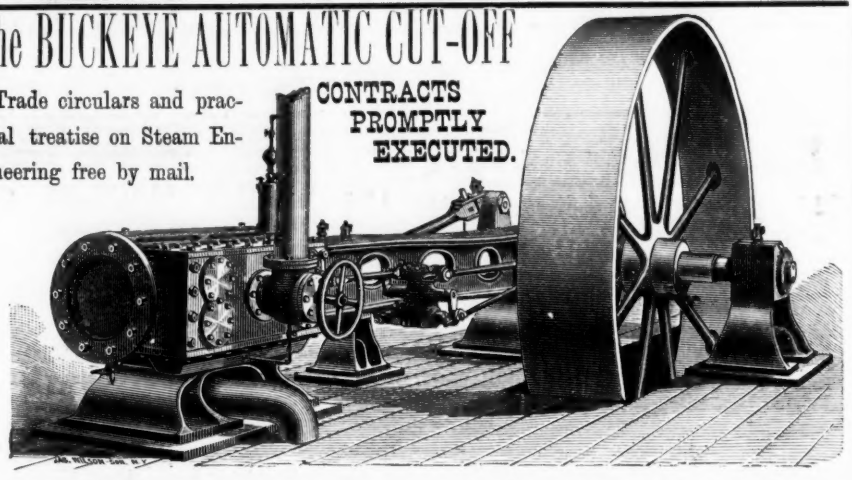

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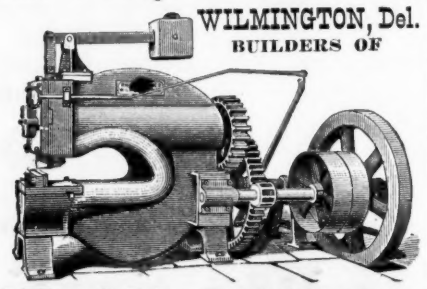

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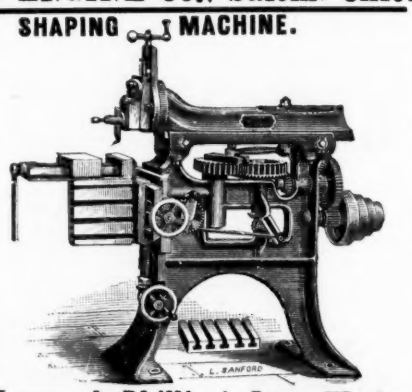

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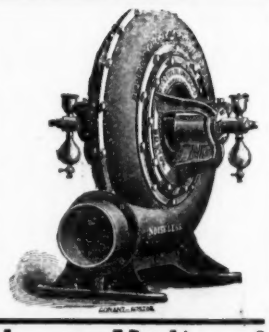

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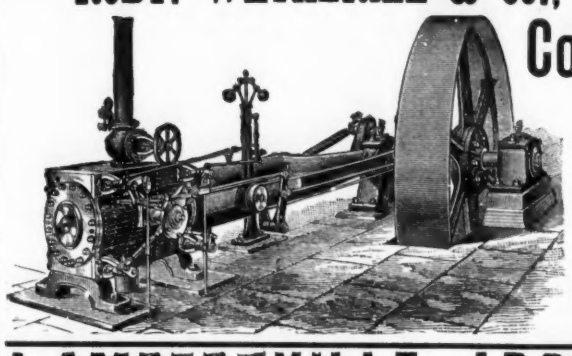

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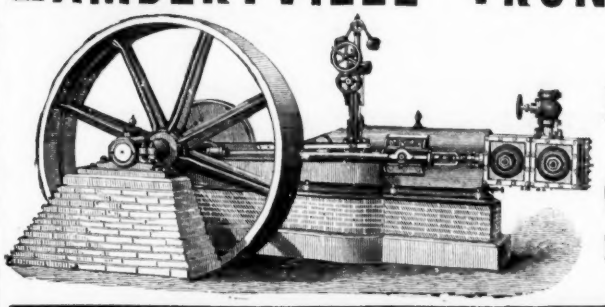

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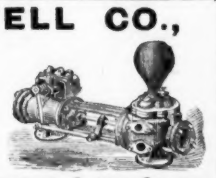

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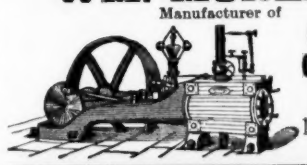

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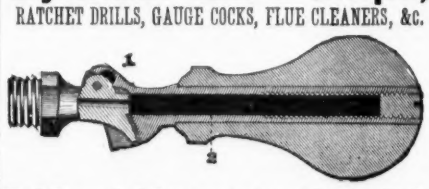

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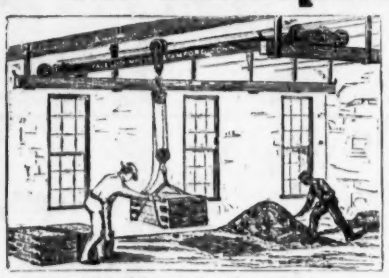

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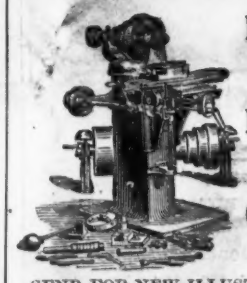

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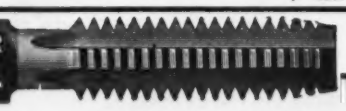

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